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1. INTRODUCTION

The United States and Canada are the largest international trading partners in the world. In recent years, goods worth approximately 150 billion U.S. dollars have crossed the border annually between the two nations. Roughly 75 percent of Canadian exports go to the United States, while 22 percent of U.S. exports go to Canada.

Prior to the late 1970s, imports from Canada were not perceived as a major problem in the United States. However, with a continued appreciation of the U.S. dollar against the Canadian dollar since 1977, the U.S. merchandise trade deficit with Canada has grown; trade deficits in 1983, 1984, and 1985 were roughly $12 billion, $15 billion, and $20 billion, respectively. After Japan, Canada enjoys the largest trade surplus of any single country with the United States.

As the trade deficit with Canada has increased, several U.S. industries have been affected. Canada supplied 33 percent of the $11 billion U.S. wood market in 1985. The U.S. wood industry claims that the Canadians are responsible for the closing of 25 sawmills and the loss of 27,000 jobs. Canadian automobile exports account for one-third of the trade deficit. Out of 1.8 million units manufactured in Canada in 1984, 1.5 million were exported to the United States. As a result of increased competition, several industries have brought cases before the U.S. International Trade Commission, seeking relief against Canadian exports.

The fresh carrot industry in the Northeast and Midwest is one of the industries that has felt the impact of increased imports from Canada. From mid July to mid November producers in Quebec and Ontario compete in U.S. markets with producers in the Northeast and Midwest. Since 1978, Canadian exports of fresh carrots to the United States have roughly doubled. Exports are now in excess of 60,000 metric tons. This represents about 10 percent of U.S. fresh carrot production. In the last two Canadian marketing years (August-July), the volume of Canadian carrot exports to the United States has surpassed U.S. exports to Canada, reversing the historical pattern of a U.S. trade surplus.[1]

As a result of the increased competition, allegations have been made that the increase in Canadian exports is the result of government subsidization. Canadian producers receive various forms of assistance through provincial and federal government programs. The question is whether these have had a significant impact on the competitive position of Canadian carrots in U.S. markets and have caused the growth of imports from Canada, or whether the increase in imports is due to other factors. This study seeks to evaluate the potential causes of increased carrot shipments to the United States.

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[1] The United States typically exports carrots to Canada in the winter, spring, and early summer, when prices are higher than in late summer and fall, when Canadian exports enter the United States.

2. THE CANADIAN MARKET AND EXPORTS

In order to analyze the factors which have contributed to the increase in U.S. imports of carrots, it is necessary to have a perspective on market developments in Canada and their relationship to trade. This section discusses trends in Canadian production and consumption, the marketing system, and trends in exports.

Production and Consumption

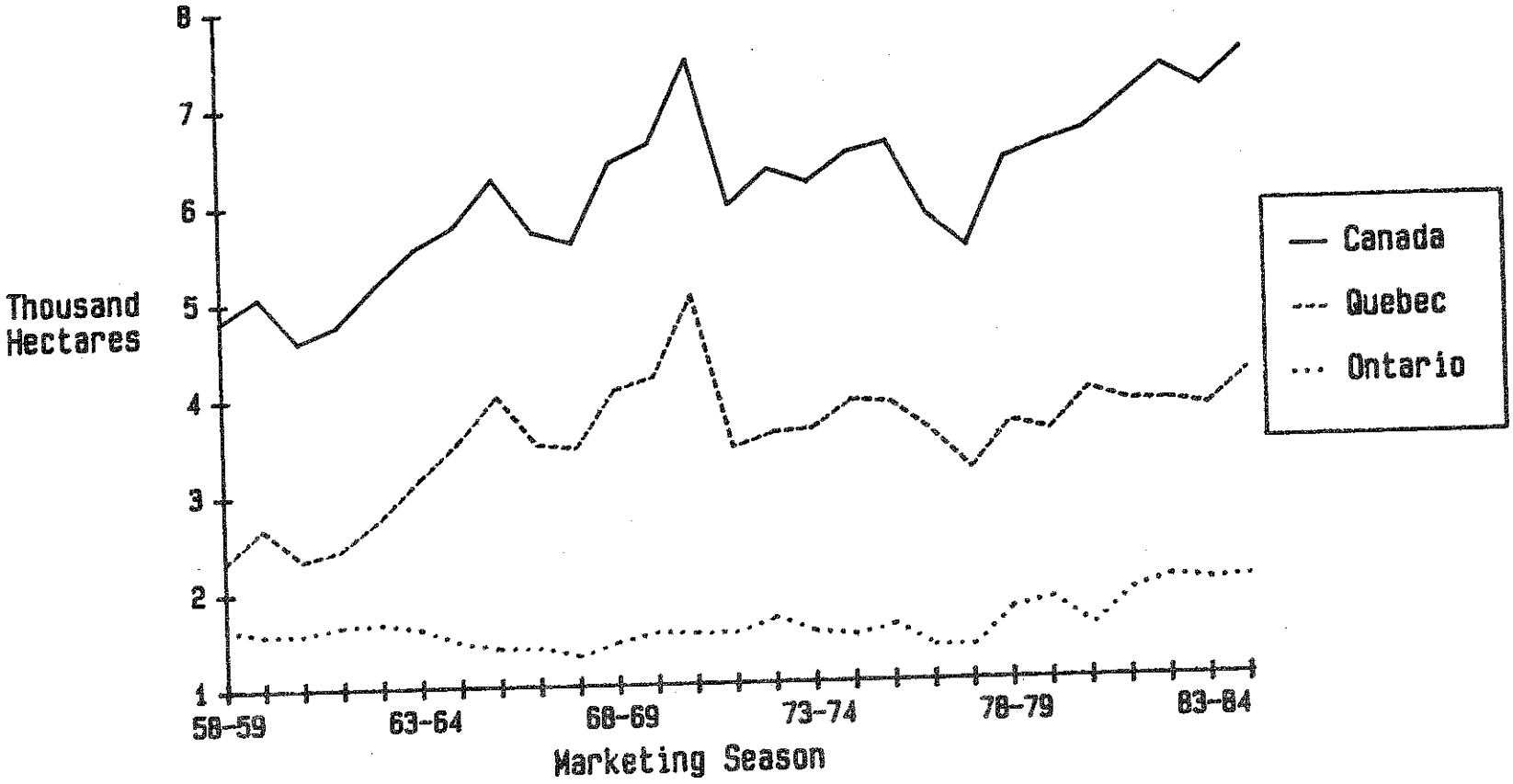
Ontario and Quebec dominate Canadian fresh carrot production. Carrots are produced almost exclusively on muck soils and both provinces have extensive areas of such soils. In Ontario the muck soils are located in the Bradford and Holland marshes. In Quebec these soils are adjacent to Montreal. Muck soil is ideal for carrots because it is loose, contains considerable reserve food material, and needs little nitrogen. Because of these qualities, the soils tend to give high carrot yields. However, muck soils do have drawbacks. They suffer from bad drainage, and are susceptible to frost and wind erosion.

Figure 2.1 graphs the total carrot area (fresh and processing) in hectares for Canada, Ontario, and Quebec for the 1958-59 to 1984-85 marketing years. The graph shows that during the period, crop area increased. In the late 1950s, Canada's carrot area was under 5000 hectares, but in recent years it has exceeded 7000 hectares. Quebec's area increased from the late 1950s until the mid-1970s, and thereafter was flat. Ontario's carrot area began the period fairly flat, but from 1977-78 to 1984-85 it increased from 1500 to 2000 hectares. Canadian crop area growth was driven by Quebec in the 1958-59 to 1976-77 period and subsequently by Ontario.

Like total area, Canadian production of fresh carrots has increased. Figure 2.2 plots fresh production in thousand metric tons for Canada, Ontario, and Quebec since the 1972-73 marketing year. Fresh carrot production was calculated by subtracting processing carrot production from total production. Fresh production has increased by 100 percent since 1972. By the early 1980s, Canada was producing over 200 thousand metric tons, equivalent to about 30 percent of U.S. production. Although Quebec has close to twice as much total carrot area, Ontario produced more fresh carrots than Quebec for nine of the thirteen years. This is due to higher yields in Ontario.

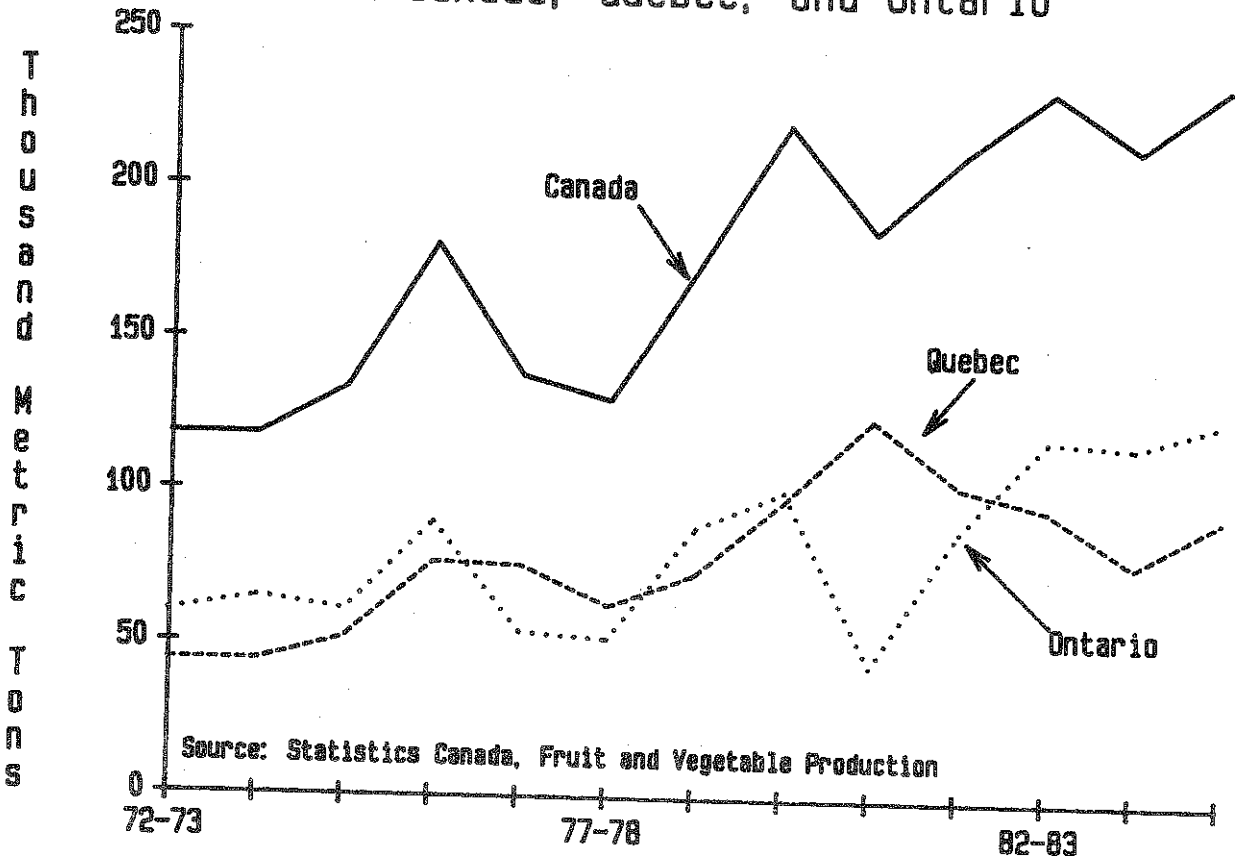
Trends in Canadian carrot consumption are illustrated by figure 2.3. In the late 1960s per capita consumption was 14 pounds, but by the 1980s had increased to 22 pounds. This is in contrast to the situation in the United States where per capita consumption has remained in the range of seven to nine pounds since the early 1950s (USDA). On the right axis of figure 2.3 Canadian per capita consumption of canned and frozen carrots is graphed. The consumption of frozen carrots has increased (as it has in the United States). Frozen carrots were not introduced into Canada until 1963, but were immediately successful. In 1968 consumption was already in excess of one-half pound and increased throughout the period; in 1984 frozen consumption was about three and one-half pounds. The increase in frozen carrot consumption was responsible for the growing spread between total and

Figure 2.1: Carrot Area in Canada, Quebec, and Ontario



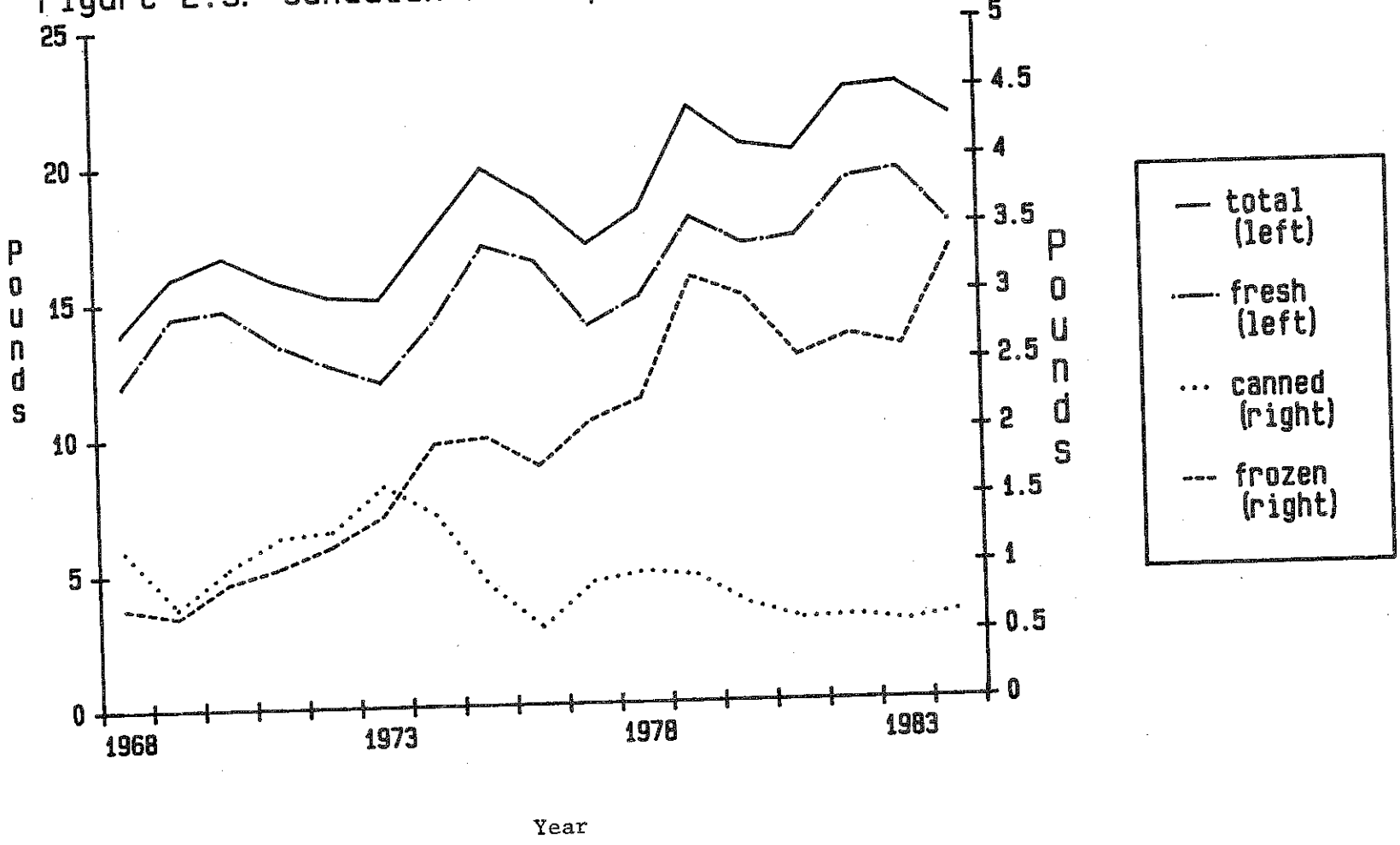
Source: Statistics Canada, Fruit and Vegetable Production.

Figure 2.2: Fresh Carrot Production in Canada, Quebec, and Ontario



Source: Statistics Canada, Fruit and Vegetable Production.

Figure 2.3: Canadian Per Capita Consumption of Carrots



Source: Statistics Canada, Crops Section, Horticultural Crops Unit.

fresh consumption. Consumption of canned carrots rose until 1973, decreased from 1973 to 1976, and was subsequently flat. Overall, the increased Canadian production of carrots has not only been directed to the export market; higher domestic consumption has absorbed some of the increase in domestic production.

The Marketing System

The marketing organization for fresh Canadian carrots has five levels: product source, packers and processors, exporters, wholesalers, and retailers. Because the fresh and processing marketing systems are intertwined, part of the marketing organization for processing carrots is included.

Fresh carrots in Canada originate from three sources: producers, producer storage, and U.S. imports. Producers sell to both packers and processors direct from the field or from farm storage. Such storage has become increasingly important. After harvest, all nonimported carrots originate from storage facilities. Because processors find that they can use their facilities in a more efficient manner when the processing season is lengthened, they have contracted with producers for storage space. Although such facilities are used for the storage of processing carrots, their major use is for fresh storage.

Imported carrots are another important source of fresh carrots in Canada. Imports originate primarily from California, and secondarily from Texas and Florida. Unlike exports, which are shipped by refrigerated trucks, imports arrive by rail in 50 pound bulk burlap bags.

Packers are the heart of the marketing organization. They are located in production areas and specialize only in packing; as a rule packers are not also growers. Packers sort, grade, wash, and pack for the wholesale and retail markets. The standard product is uniform, high grade, and topped (i.e. stems and leaves are removed). Fresh carrots are marketed more by shape and grade than by variety. They are then packed in 50 pound master containers (heavy duty plastic bags) within which are 48 one-pound bags, 24 two-pound bags, or 15 three-pound bags. Since each consumer-size bag must meet or exceed weight standards, the master container usually weighs in excess of 50 pounds. Carrots stay fresh longer when placed in plastic bags. Those that fail to meet packer standards are sold as cattle feed, used as filler in pet food, or sent to food processors which have lower raw product standards.

After leaving the packinghouse, carrots are shipped to wholesalers, retailers, and exporters. The wholesale trade is synonymous with terminal markets. The role of wholesalers has diminished with time. Wholesalers in turn sell to small nonchain grocery stores who are unable to buy in the volume that packers require. The largest buyers of fresh carrots are grocery chains. Carrots going into export channels are purchased by U.S. grocery chains, repacked by U.S. firms such as Brock's in Buffalo, or are sold on consignment.

As indicated above, on-farm storage has played an increasingly important role in the Canadian marketing system. The number of storage

facilities has expanded in both Ontario and Quebec. As supplies are reduced over the course of the marketing season, prices rise. If farmers are able to find a low cost method of storage, they are able to sell later in the season, when prices are higher. The volume of carrots in storage is generally highest in November and declines thereafter.

Figure 2.4 illustrates November's storage in metric tons for the 1958-59 to 1984-85 marketing years. It indicates that yearly storage in Canada has increased. The increase is especially marked in the last three storage seasons. In the 1960s storage was in the 20 thousand to 40 thousand metric ton range, but in the late 1970s, the range increased to 75 to 130 thousand metric tons. It is useful to compare the rate of growth of storage to total production. The solid line in figure 2.4 graphs storage as a percentage of production. The scale is on the right hand side. The graph shows an increasing trend in the ratio of storage to production throughout the period. For two of the last three marketing years, storage exceeded 40 percent of production.

Exports

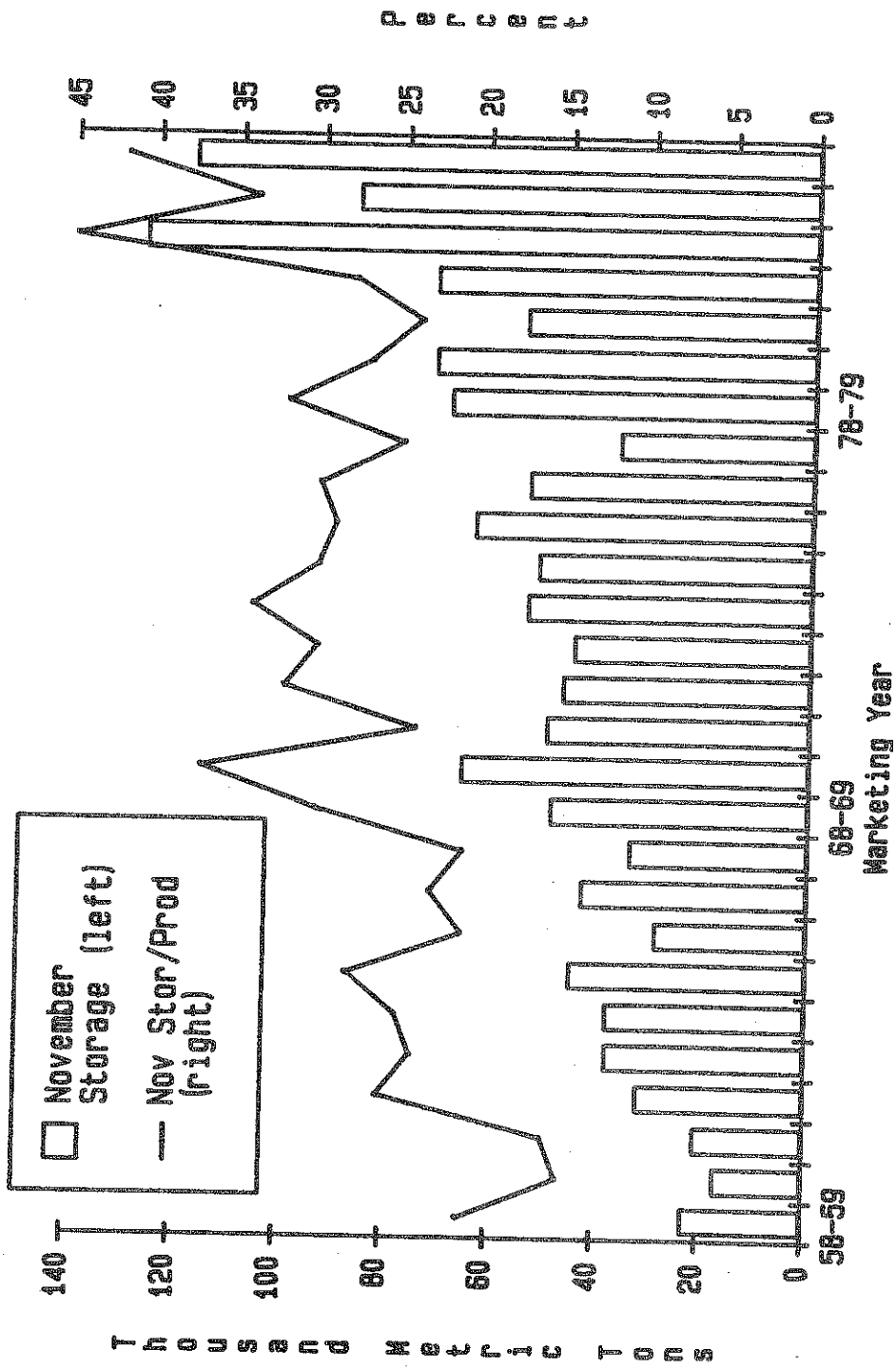
Between the 1961-62 and 1978-79 marketing years, Canadian imports and exports of fresh carrots displayed no discernible trend (figure 2.5). Prior to 1978-79, Canadian exports were about 25,000 metric tons and imports were about 35,000 tons. Following the 1978-79 marketing year, both imports and exports increased. In 1984-85, exports and imports exceeded 60,000 and 50,000 metric tons respectively. Between 1961-62 (when the Canadian government first began to publish fresh carrot export statistics) and 1982-83, imports exceeded exports. After the 1978-79 marketing year, however, exports grew at a faster rate than imports so that in the 1983-84 and 1984-85 marketing years, Canada was a net exporter of fresh carrots. This is shown in figure 2.5 where the black line crosses and exceeds the dotted line.

Due to its harsh climate, Canada is unable to grow more than one crop of carrots in a 12 month period. Canadian producers harvest from late July to early November. The marketing year for fresh carrots runs from August through July of the following year. By May, supplies in cold storage are largely exhausted. Unlike Canada, the United States is able to harvest year-round due to favorable climatic conditions in California, Texas, and Florida. The single growing season in Canada and the multiple growing seasons in the United States are reflected in the Canadian intramarketing year pattern of trade.

Figure 2.6 demonstrates the average intramarketing year trade pattern for Canadian fresh carrots for the years 1980 to 1985. From August, exports (the solid line) increase until they peak in October. After October, exports decline and almost cease in May. From May through July exports are low. Imports follow the opposite pattern to exports. From August through November, imports (the dotted line) remain low. In December imports increase until they peak in May. From June to July imports decrease, although they are still at a significant level.

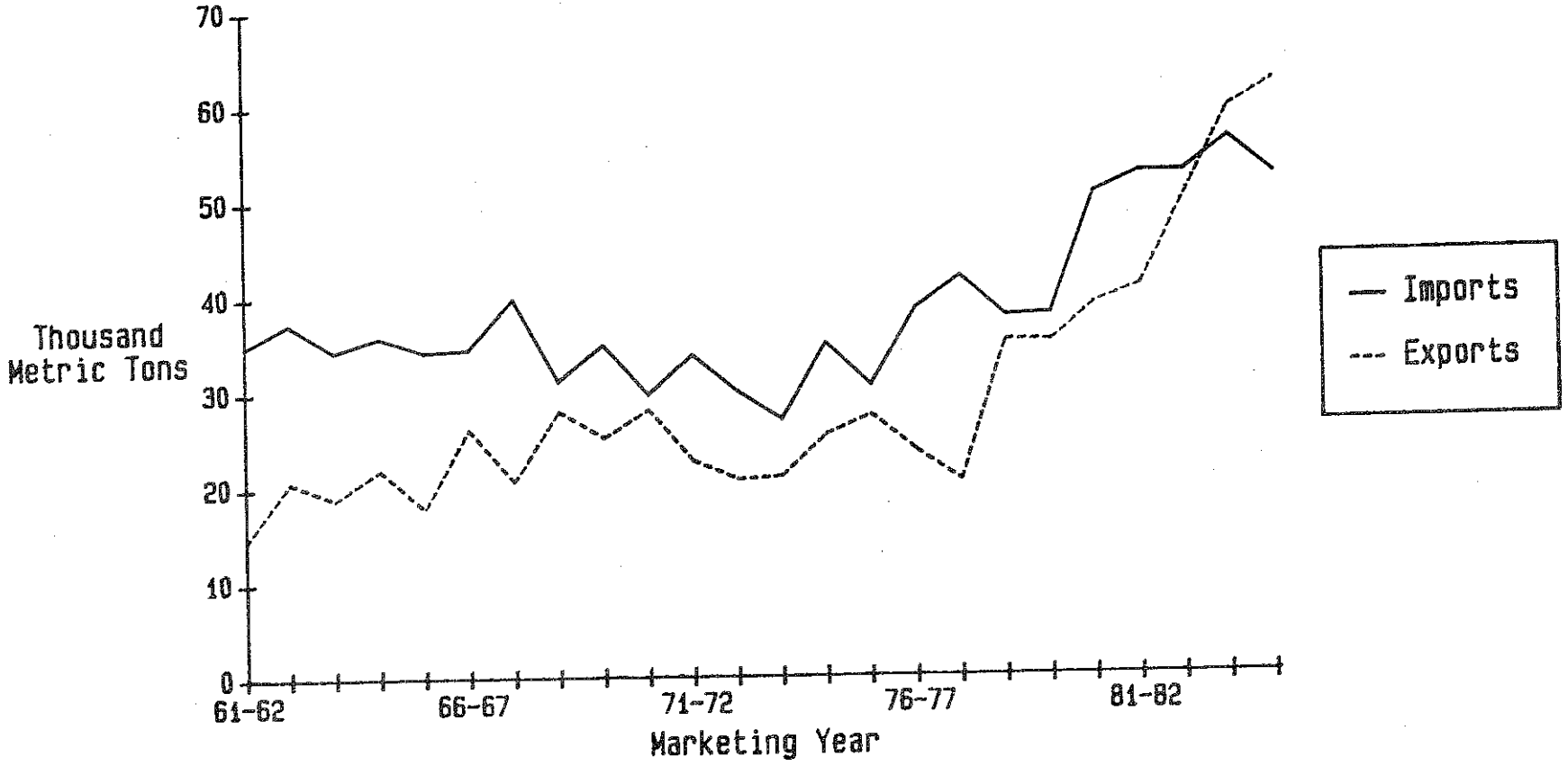
The intramarketing year export pattern has not remained constant over time. Since the early 1960s, an increasing proportion of carrot exports

Figure 2.4: Volume of Canadian Carrots Stored in November



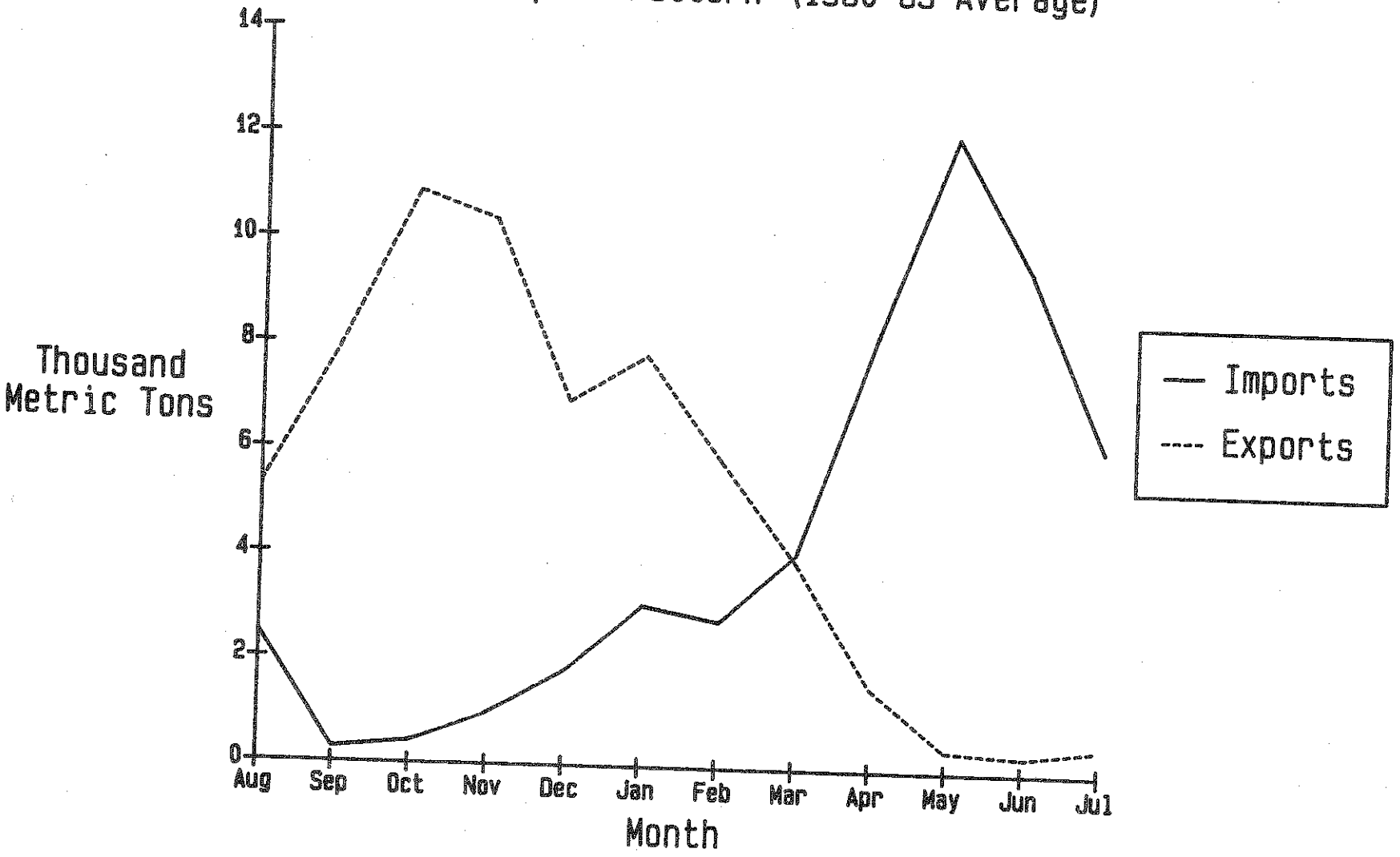
Source: Statistics Canada, Fruit and Vegetable Production and Stocks of Food Commodities in Cold Storage and Other Warehouses.

Figure 2.5: Canadian Imports and Exports of Fresh Carrots



Source: Statistics Canada, Trade of Canada: Exports by Commodity.

Figure 2.6: Canadian Marketing Year Fresh Carrot Export and Import Pattern (1980-85 Average)



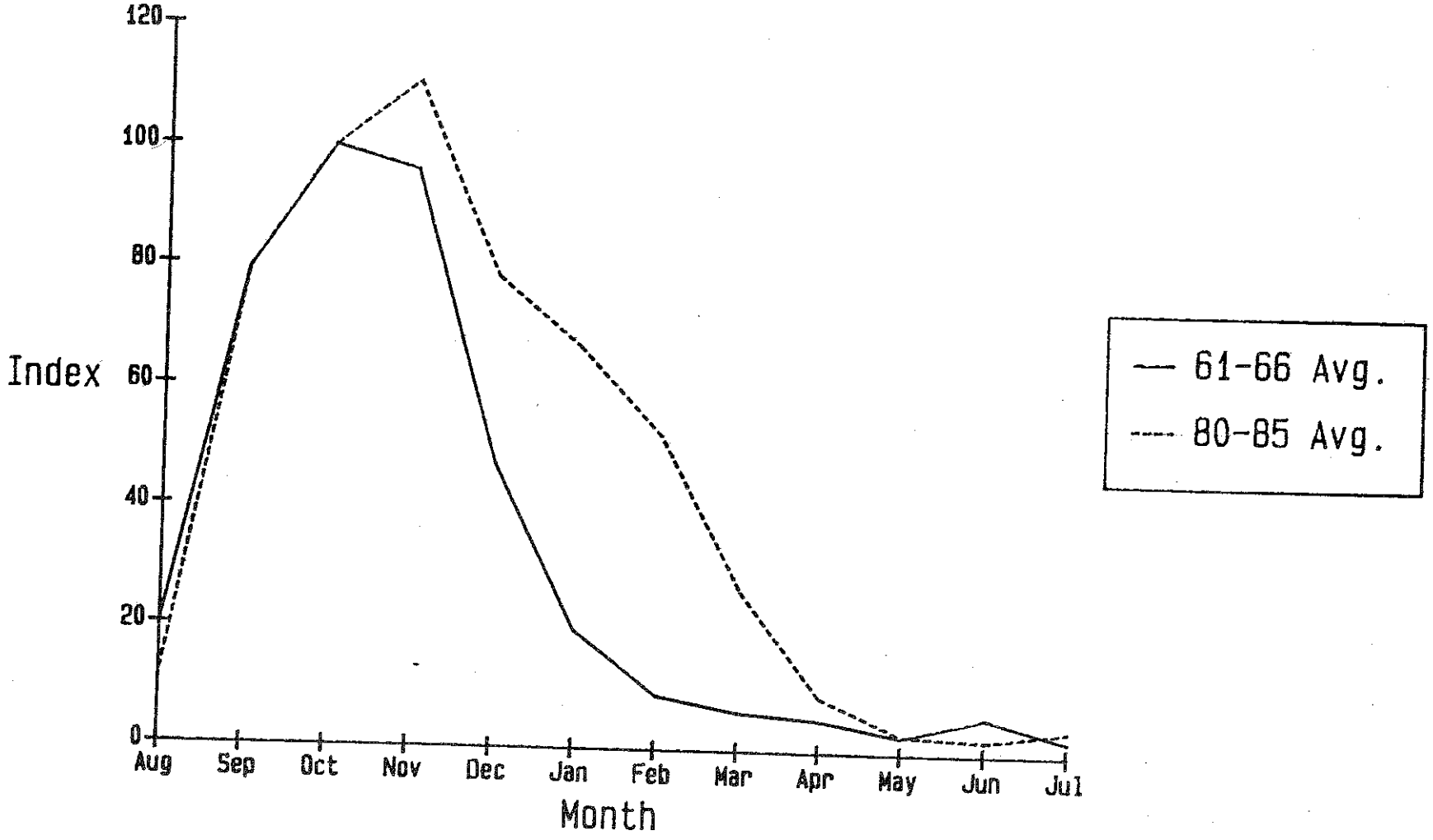
Source: Statistics Canada, Trade of Canada: Exports by Commodity.

has been shipped in later months. This is demonstrated in figure 2.7, which graphs averaged monthly exports for the 1961-66 and 1980-85 periods. The data were standardized by dividing by the October average for each period. In the earlier 1961-66 period, exports (the solid black line) increased rapidly from August to October and then declined almost as rapidly. The export season was largely finished by February. In 1980-85, exports (the dotted line) rose from August to October as in the earlier period, but did not fall as rapidly in the later months. From December through March a greater percentage of the total was exported in 1980-85 than in 1961-66. Exports have not only increased on a marketing year basis, but the marketing year has shifted as well. A greater proportion of Canadian exports is now shipped in later months.

Canadian exports of fresh carrots to the United States do not affect all areas of the country equally. U.S. Commerce Department statistics indicate that carrots imported from Canada cross the border almost exclusively in the states of Michigan, New York, and Vermont, transported in semi-trailer trucks. In 1983, for example, over 90 percent of the imports of carrots from Canada crossed the border into New York State. This volume was equally divided between the Buffalo and St. Lawrence River areas. Figure 2.8 indicates that the bulk of the imports are into the Northeast and that Northeastern imports have grown at a similar rate as total U.S. imports, remaining a consistently high percentage of U.S. imports. Little direct evidence is available to indicate final destinations. However, figures on wholesale market truck unloadings and the opinions of industry personnel suggests that the primary markets are Buffalo, Boston, and New York City.

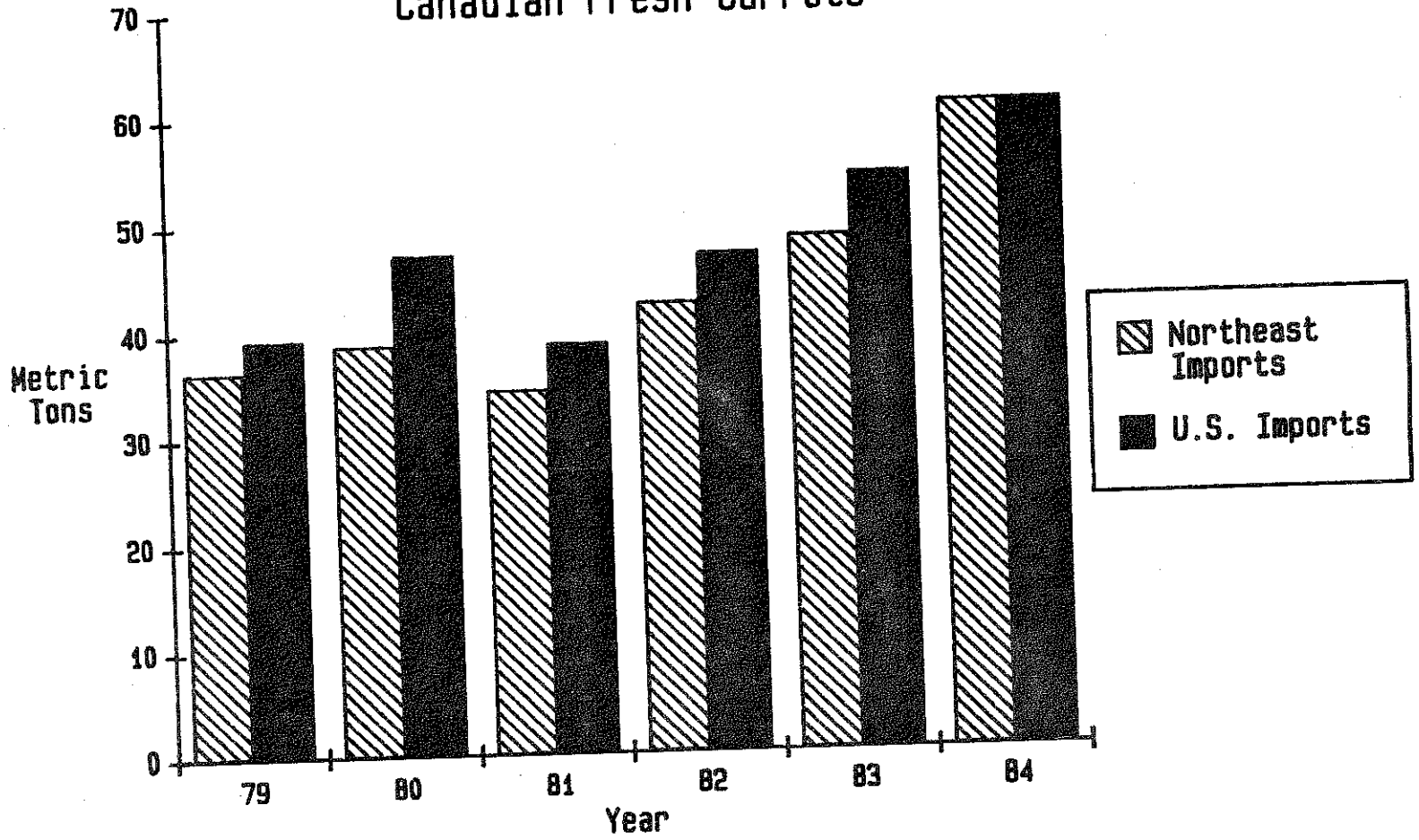
Although exports of carrots from Canada have increased in absolute terms, they may not have increased in relative terms. The increase in exports may simply be in line with the overall increase in domestic production. Figure 2.9 graphs total exports and exports as a percentage of production by marketing year. The graph demonstrates that both the volume of carrot exports and exports as a percentage of production increased. Prior to the 1979-80 market year, exports were about 15 percent of production, but by 1983-84 the ratio had risen to 22 percent. This suggests that export growth is not merely a result of increased domestic production. The strong growth in imports of Canadian carrots, and their importance in Northeast markets have contributed to the perception in the region that this is the result of "unfair" competition.

Figure 2.7: Marketing Year Profile of Canadian Fresh Carrot Exports, 1961-66 and 1980-85 Averages (Oct.=100)



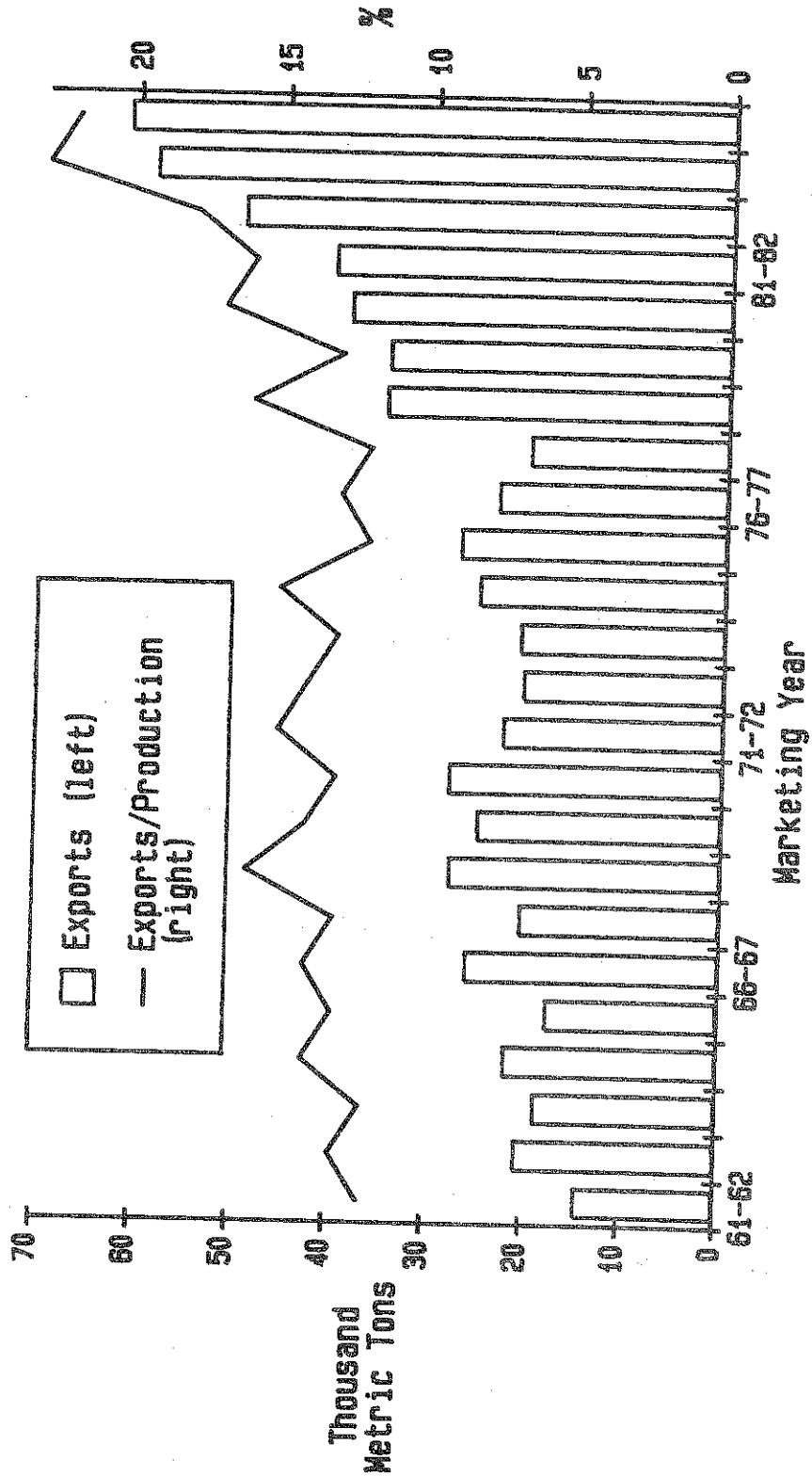
Source: Statistics Canada, Trade of Canada: Exports by Commodity.

Figure 2.8: U.S. and Northeast Imports of Canadian Fresh Carrots



Source: U.S. Commerce Dept., U.S. General Imports: Schedule A: Commodity by Custom District.

Figure 2.9: Canadian Fresh Carrot Exports and Production



Source: Statistics Canada, Trade of Canada: Exports by Commodity and Fruit and Vegetable Production.

3. EXTERNAL FACTORS CONTRIBUTING TO INCREASED EXPORTS

A number of factors which are external to the Canadian agricultural sector and its carrot industry may have contributed to increased exports to the United States. These factors are changes in the exchange rate, U.S. tariffs, and Florida production problems. These factors are discussed in this section of the report.

The Exchange Rate

If the value of the U.S. dollar in terms of the Canadian dollar changes then, other things being equal, this should affect the relative attractiveness of the U.S. market for Canadian exporters. In particular, the appreciation of the U.S. dollar (increase in its value against its Canadian counterpart) means that U.S. market prices in Canadian dollars will increase. The proceeds from exports to the U.S. market will rise and exports could be expected to increase.

A time series for both the exchange rate and Canadian carrot exports on an annual basis since 1970 is graphed in figure 3.1. Exports in thousand metric tons are represented by the bars; their scale is on the left axis. The Canadian dollar price of the U.S. dollar is represented by the line; its scale is on the right axis. There is a pattern of both increasing exports and an increasing exchange rate after 1976. Exports increased as the value of the U.S. dollar rose against the Canadian dollar. There is, however, a lag in export response.

One way to illustrate the potential importance of the change in the exchange rate is to compare its effect on the price that Canadian carrots could receive in the United States to their price in Canada. If nominal U.S. prices are converted into Canadian dollars via the exchange rate and compared to nominal Canadian prices, then prices in Canadian dollars can be compared in the two nations. Wholesale prices for a master container of 24 two-pound bags (24-2) of Canadian carrots were gathered from terminal markets in Buffalo, Toronto, and Montreal. The Niagara Frontier Terminal Market in Buffalo quotes daily price spreads for 24-2 Canadian carrots from August through March. The terminal markets of Toronto and Montreal quote weekly price spreads for Ontario and Quebec 24-2 carrots, respectively. Midpoints of the price spreads were used. Weekly and daily prices were averaged to form a monthly price. It is assumed that the product in the three markets is of similar quality and, on average, equal quantities are sold on each day and week within the month.

Ratios are formed of the November and January Buffalo prices over the Montreal and Toronto prices for a ten year period. This ratio is computed both with and without exchange rate effects. In figures 3.2 and 3.3, the x's represent the price ratios without, and the o's the price ratio with the exchange rate effects for the Buffalo-Toronto comparison. The average monthly exchange rate for the Canadian dollar price of U.S. dollars is noted above the o's.

Even without considering the exchange rate effect, Buffalo prices are roughly 110 to 150 percent of Montreal and Toronto prices. With the exchange rate effects, monthly Buffalo wholesale prices (Canadian $) are up

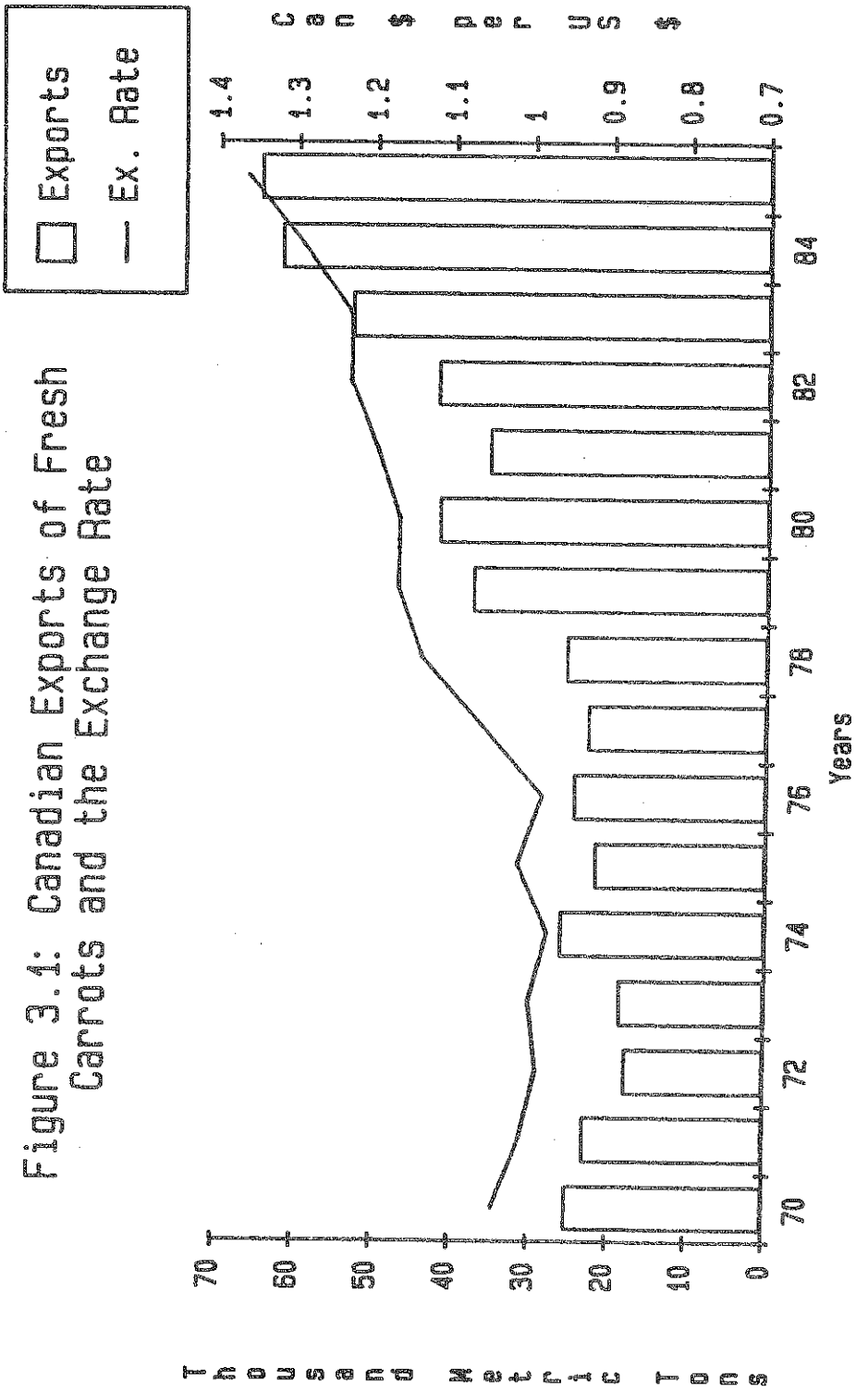
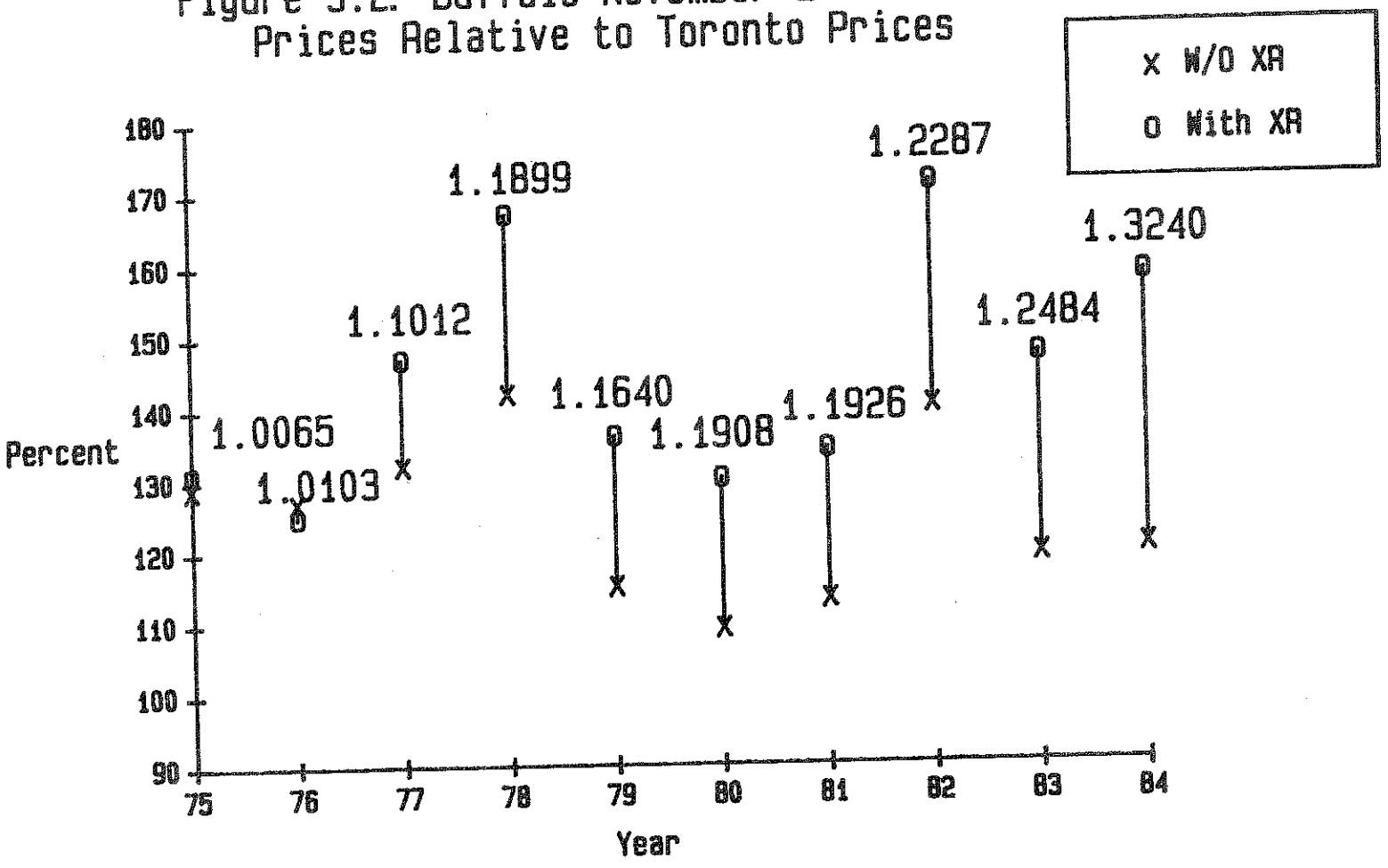


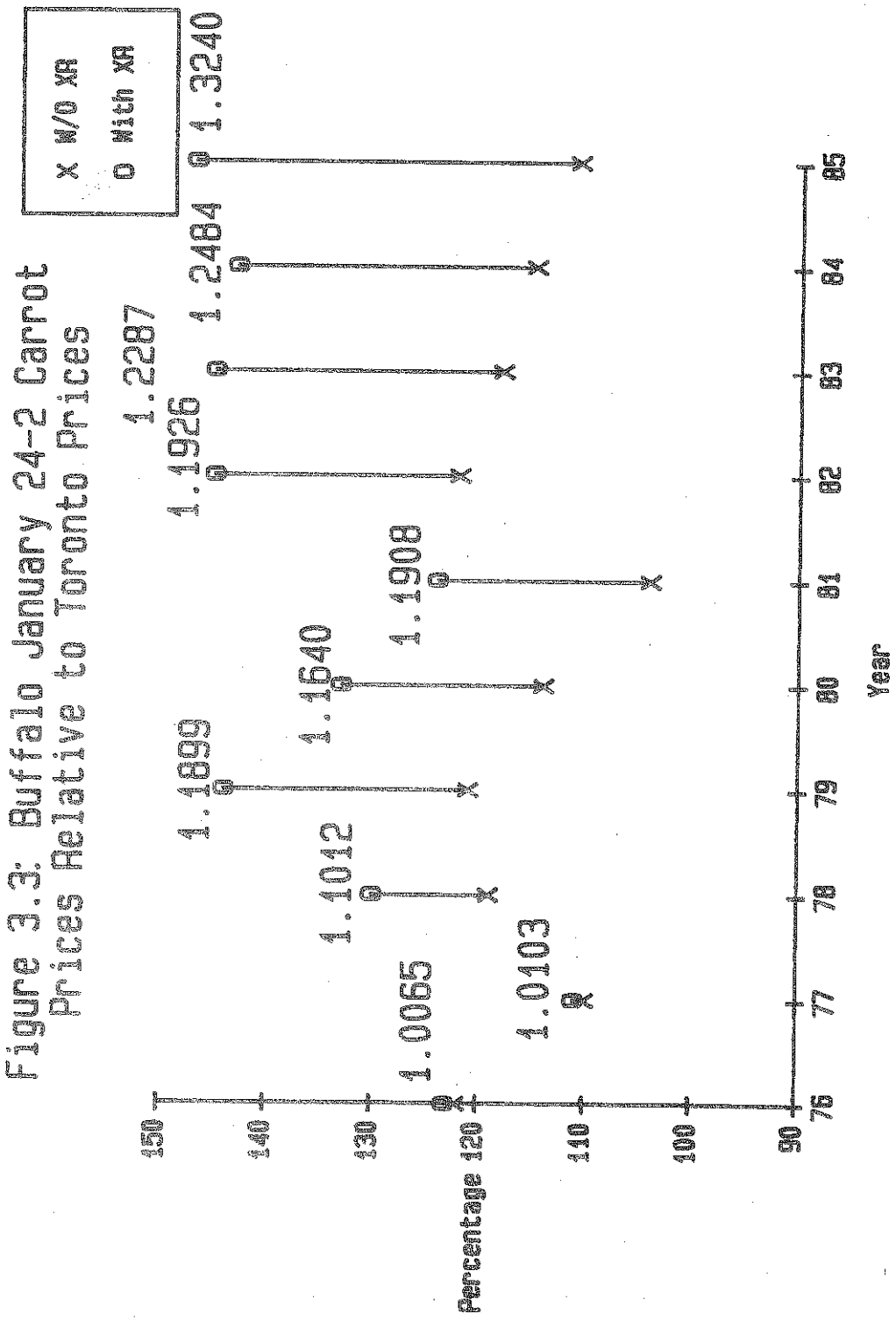
Figure 3.1: Canadian Exports of Fresh Carrots and the Exchange Rate

Source: IMF and Statistics Canada, Trade of Canada: Exports by Commodity.

Figure 3.2: Buffalo November 24-2 Carrot Prices Relative to Toronto Prices



Source: Agriculture Canada, Fruit, Vegetable and Honey Crop and Market Report; IMF; N.Y. Dept. of Ag. and Markets.



Source: Agriculture Canada, Fruit, Vegetable and Honey Crop and Market Report; IMF; N.Y. Dept. of Ag. and Markets.

to 190 percent of Montreal's and Toronto's prices. The magnitude of the exchange rate effect upon relative prices is indicated by the length of the vertical lines in the diagrams. Note that the height of the line is not only a function of the exchange rate, but also of the price ratio without the exchange rate effect. For example, the difference between 10 and 12.1 (11 x 1.1) is smaller than the difference between 10 and 13.2 (12 x 1.1). In 1975 and 1976, the U.S. and Canadian dollar were at par, although there was still a 25 to 30 percent price premium in the Buffalo market relative to Toronto. In 1977 the exchange rate became a factor. The exchange rate increased the Buffalo premium from 30 to 45 percent. In 1979 to 1981, the Buffalo and Toronto prices drew closer together. This normally would reduce exports, but due to an exchange rate just below 1.20, the premium in the Buffalo market was still high. After the price gap again increased in 1982, the Buffalo premium rose to its highest level.

A change in the exchange rate will not necessarily bring about a change in the volume of trade. The movement in the exchange rate may simply reflect differential rates of inflation between countries. If the rate of domestic inflation in Canada is higher than that in the United States, its currency may depreciate but the relative competitiveness of the industries in the two countries may be unaffected (i.e., costs expressed in a common currency after adjusting for the difference in the price level remain the same). Changes in the exchange rate simply offset the differential rate of inflation in the two countries, and do not create a change in the pattern of trade.

One way to determine if this has in fact been the case is to compute an index of relative industrial competitiveness and to compare this to the changes in the exchange rate. Such an index may be constructed by forming the ratio of the two countries' domestic producer price indices and multiplying this ratio by the exchange rate. If the price indices for both countries have the same base year, then the resulting index for the base period should equal the exchange rate. If the index remains constant as time passes, then either costs and the exchange rate remain constant, or the exchange rate changes so as to adjust for differential rates of change in costs.[2]

In order to make this comparison for the United States and Canada, the ratio of the annual U.S. producer price index to the Canadian producer price index (IMF) was calculated. Both indices have a base year of 1970. This ratio was then multiplied by the annual average Canadian dollar price for U.S. dollars (OECD). In 1970 the competitiveness index is equal to 1.0442, the Canadian dollar price for U.S. dollars. If the index rises above 1.0442 then, other things being equal, the conditions for trade should move in favor of the Canadians; and if the index falls below 1.0442, trade should move in favor of the United States.

Figure 3.4 graphs this index of industrial competitiveness and the Canadian dollar price of U.S. dollars from 1970 through 1985. Both scales

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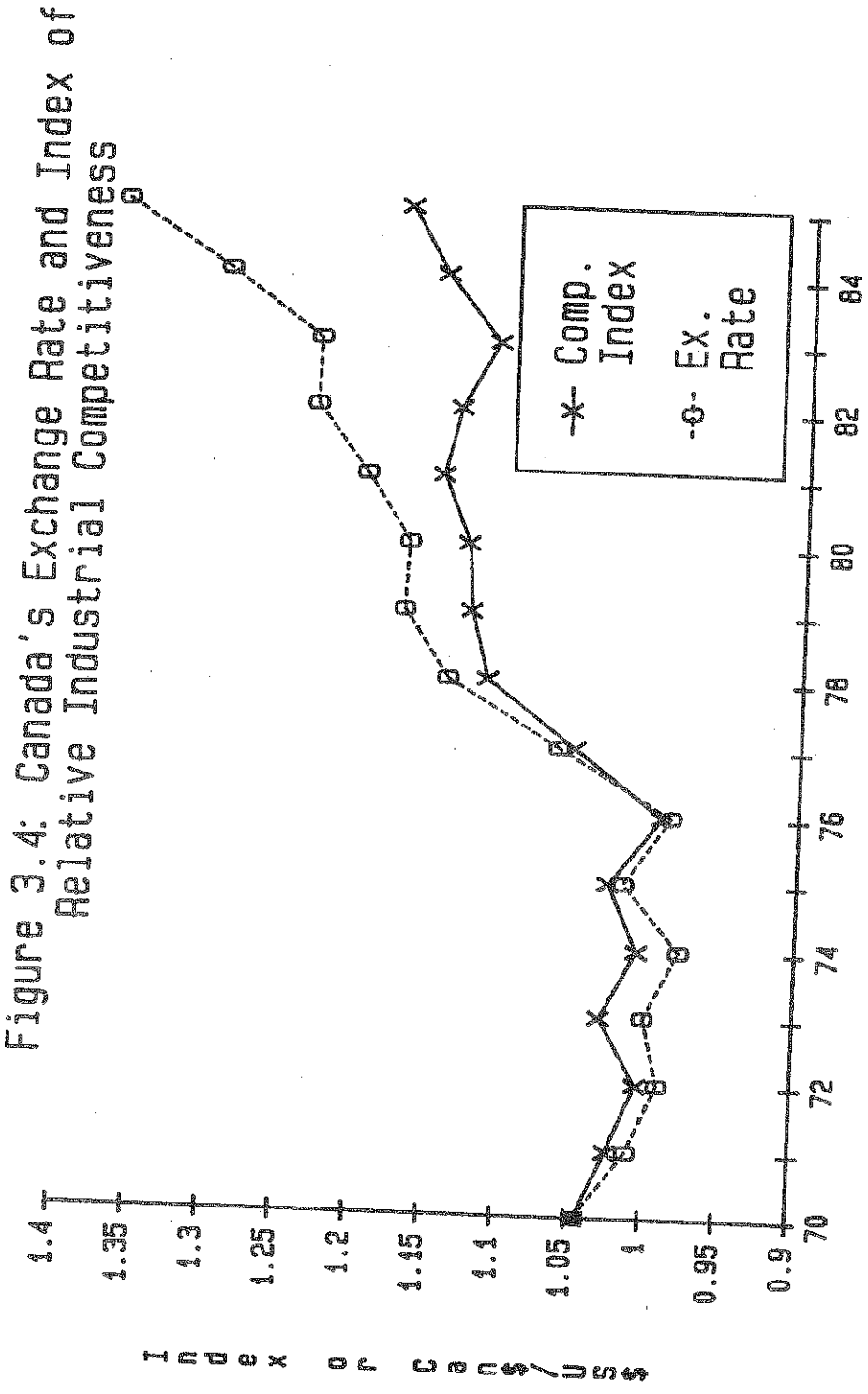
[2] This method only measures the change from the base year, and assumes there are no significant trade barriers and that a substantial amount of goods and services are traded between the two countries considered.

Figure 3.4: Canada's Exchange Rate and Index of Relative Industrial Competitiveness



Source: IMF and Bureau of Economic Statistics, Inc.

are on the left axis. From 1970 to 1976, the index and the exchange rate are close together; both remain close to one. During this period, the competitiveness index is slightly below 1.0442, which gives a slight competitive advantage to the United States. In 1977, as the U.S. dollar begins to appreciate against the Canadian dollar, both the index and the exchange rate increase. In 1979, the exchange rate and index diverge because the exchange rate begins to increase at a faster rate. During this period, Canadian producer prices increased at a faster rate than in the United States, but not as fast as the appreciation of the U.S. dollar. The diagram suggests that the change in the exchange rate has indeed tended to favor Canadian exporters although not to the extent that the change in the exchange rate alone would indicate.

Whether this argument can be extended directly to carrot exports is still an open question. Its answer depends on whether the rate of increase in Canadian production and marketing costs has been significantly different from the general rate of inflation in the Canadian economy as measured by the producer price index. It is difficult to identify precisely the extent to which changes in the exchange rate have affected the incentive for Canadian carrot producers to ship to the United States. However, analysis of production costs and relative returns presented in the following two sections of this report suggest that the general conclusion reached above would still remain valid for carrot exports.

Tariffs

Canadian carrot exports must meet U.S. health standards (be fit for human consumption), and are subject to the U.S. tariff. Although health standards can be used as a nontariff barrier to trade, this does not appear to be the case with respect to U.S. carrot imports. The same health standards that are applied to U.S. domestic fresh carrots are applied to imports. As a result the only major trade barrier is the tariff.

There are two types of tariffs used by the United States: the ad valorem tariff and the specific duty. An ad valorem tariff is levied as a specified percentage of the value that the U.S. customs places on the good for the purpose of tariff assessment. A specific duty is a fixed charge per unit, volume or weight. Both of these types of tariffs have been used in the recent past as a result of changes negotiated under the General Agreement on Tariffs and Trade (GATT). The GATT is an international organization whose primarily goal is to reduce trade barriers. Prior to the Kennedy round of negotiations under the GATT which ended in 1967, the United States levied a 12.5 percent ad valorem tariff on Canadian fresh carrot imports. Under trade agreements made in the Kennedy round, the ad valorem tariff was reduced in a series of steps. In 1969 it was reduced from 12.5 percent to 11 percent, in 1970 to 10 percent, in 1971 to 8.5 percent, in 1972 to 7 percent, and in 1975 to 6 percent -- its final level. In 1973 another round of GATT negotiations began in Tokyo and ended in Geneva in 1979. Under the Tokyo/Geneva round, the U.S. tariff was switched from an ad valorem to a specific duty. After 1979, Canadian fresh carrot exports were assessed a duty of one-half cent per pound.

In order to assess the implications of the change in the tariff for carrot exports, it is necessary to examine on a comparable basis how the

tariff has changed over time. Since the first tariff reduction was in 1969, the time period of 1965 to 1985 is used. This includes four years of data before the tariff reduction was initiated. There are two methods by which the tariff might be quantified. The first is to place all tariffs in an ad valorem form, and the second is to express them as a specific duty. Since U.S. customs used an ad valorem tariff for the 1965 to 1979 period, there is no problem in computing the ad valorem tariff for this period. The problem lies in converting the specific duty rate of one-half cent per pound, for the 1980 to 1985 period, into an ad valorem rate. To make the conversion the annual poundage of imports is first multiplied by one-half cent. This is the amount levied on imports for a calendar year. This value is then divided by the total annual customs value to determine the ad valorem rate.

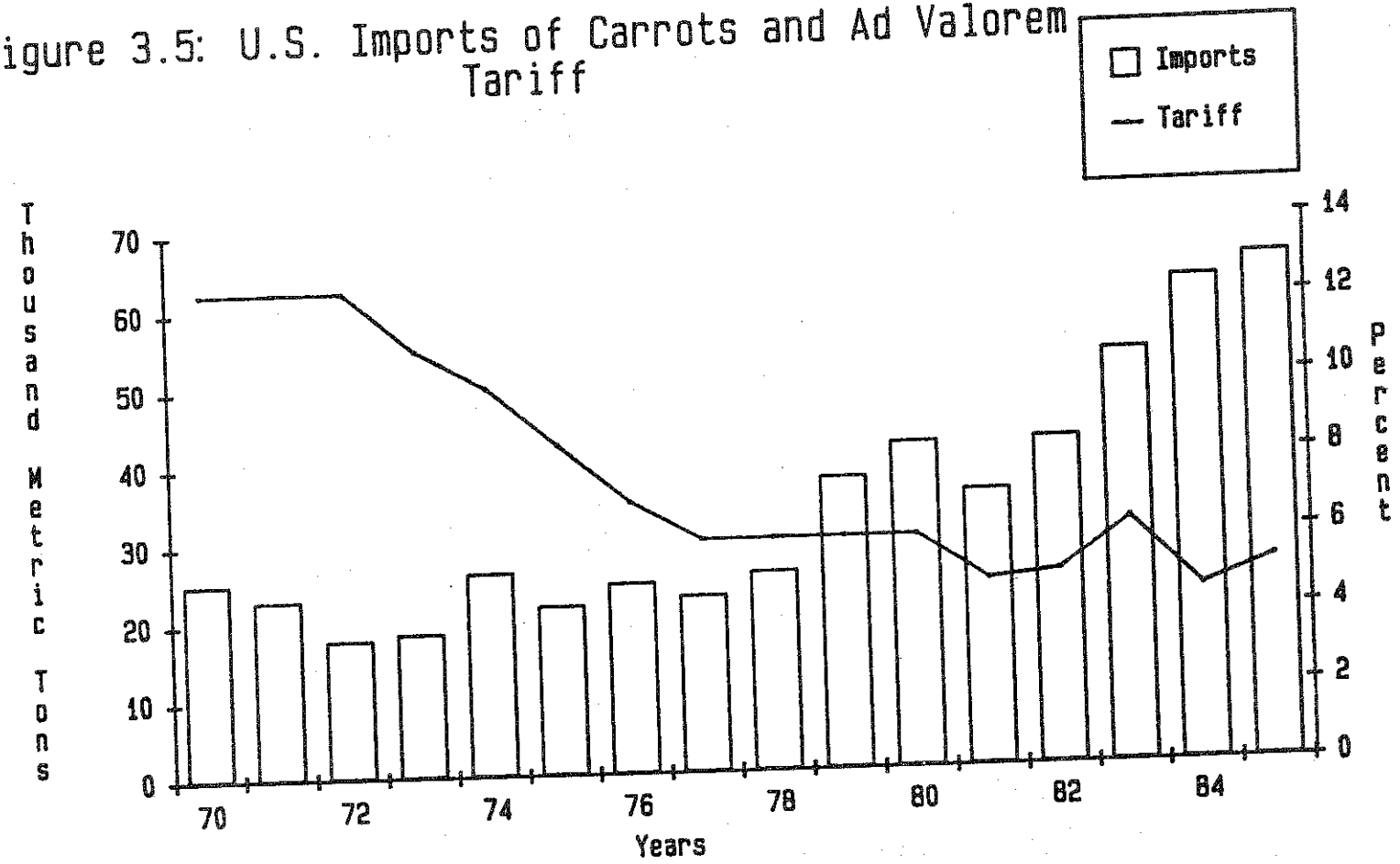
A second method of tariff comparison involves calculating the specific duty on a 50 pound master container. To find the specific duty for 1965 to 1979, annual imports in pounds are divided by the customs value to obtain the customs value per pound. The per pound customs value is then multiplied by 50 to calculate the customs value of a master container; this is multiplied by the ad valorem tariff rate to yield the specific duty per master container. The specific duty for the 1980 to 1985 period is one-half cent multiplied by 50 pounds, or 25 cents. To place the specific duty in 1985 dollars, the values are deflated by the U.S. producer price index (IMF). The discussion of the ad valorem duty assumes that U.S. customs has not changed its method of evaluating Canadian carrot imports for the purpose of levying tariffs over the 1965 to 1985 period. The ad valorem and the specific duty tariffs are graphed together with exports in figures 3.5 and 3.6.

Both methods show that the tariff on imported carrots has decreased substantially. Reduced tariffs, in effect, are reductions in costs for the exporter. Other things being equal, exporters are expected to react to reduced costs by increasing exports. The two graphs illustrate that an inverse relationship exists between the U.S. tariff and exports. However, to evaluate the significance of the tariff for exports requires further analysis in section 5.

Florida Production Problems

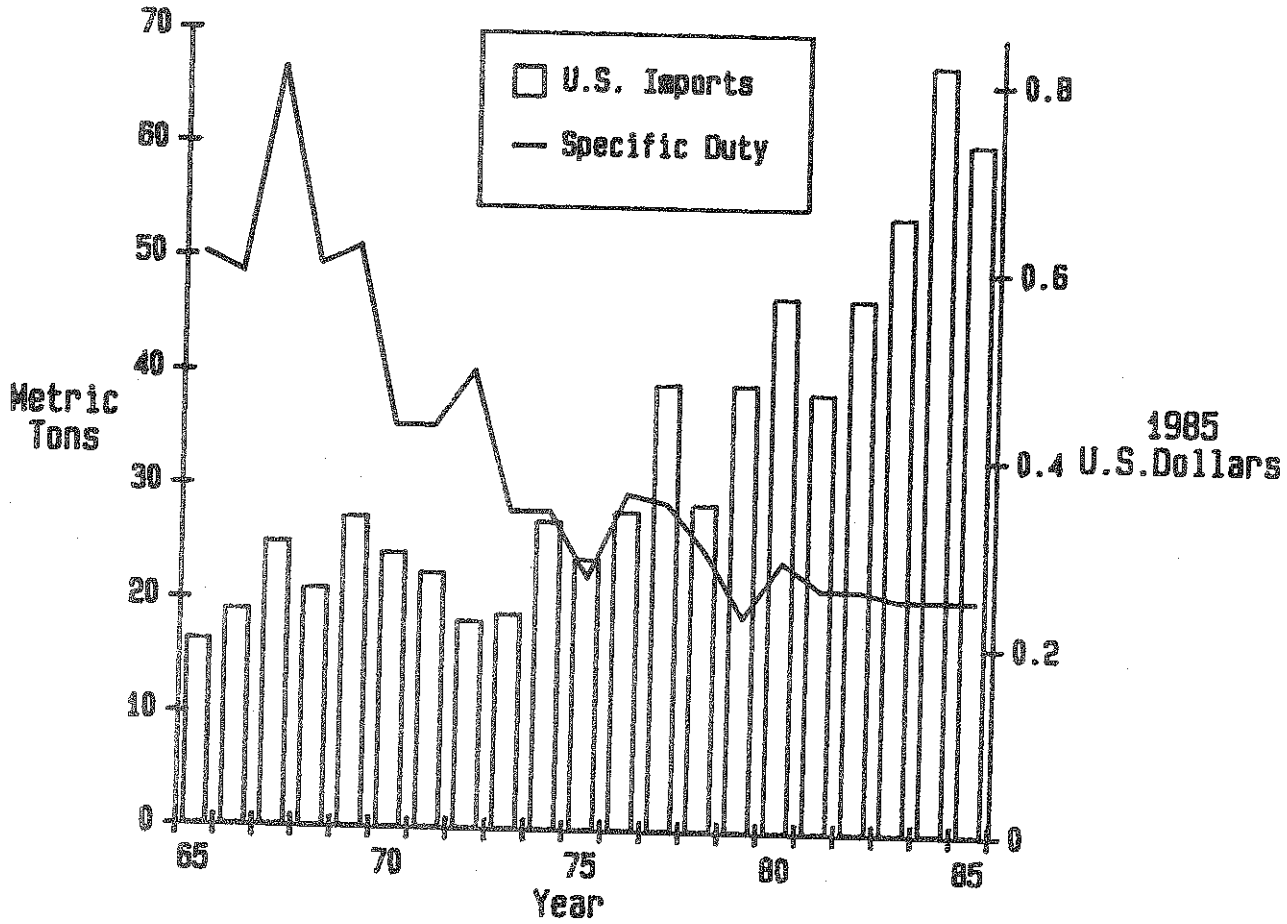
The general competitive position of the U.S. carrot industry has been affected by changes in the U.S. dollar exchange rate and the size of U.S. tariffs. However, an additional domestic factor may have been important -- production problems in Florida. Florida's carrot production is located in the central part of the state around Lake Apopak, and represents about 9 percent of U.S. production. Traditionally, Florida's markets (November to June season) have been in states east of the Mississippi and in eastern Canada. Florida competes successfully in this area because of its low transportation cost with respect to other major U.S. producers such as those in California and Texas. From December through April, Florida grower-packers are in competition with Canadian exporters in the Carolinas and points north. This competition has been affected by production problems related to weather and disease.

Figure 3.5: U.S. Imports of Carrots and Ad Valorem Tariff



Source: U.S. Dept. of Commerce, U.S. General Imports: Schedule A: Commodity by Country.

Figure 3.6: U.S. Imports and Specific Duty on 50 Lb. Master Container of Canadian Carrots

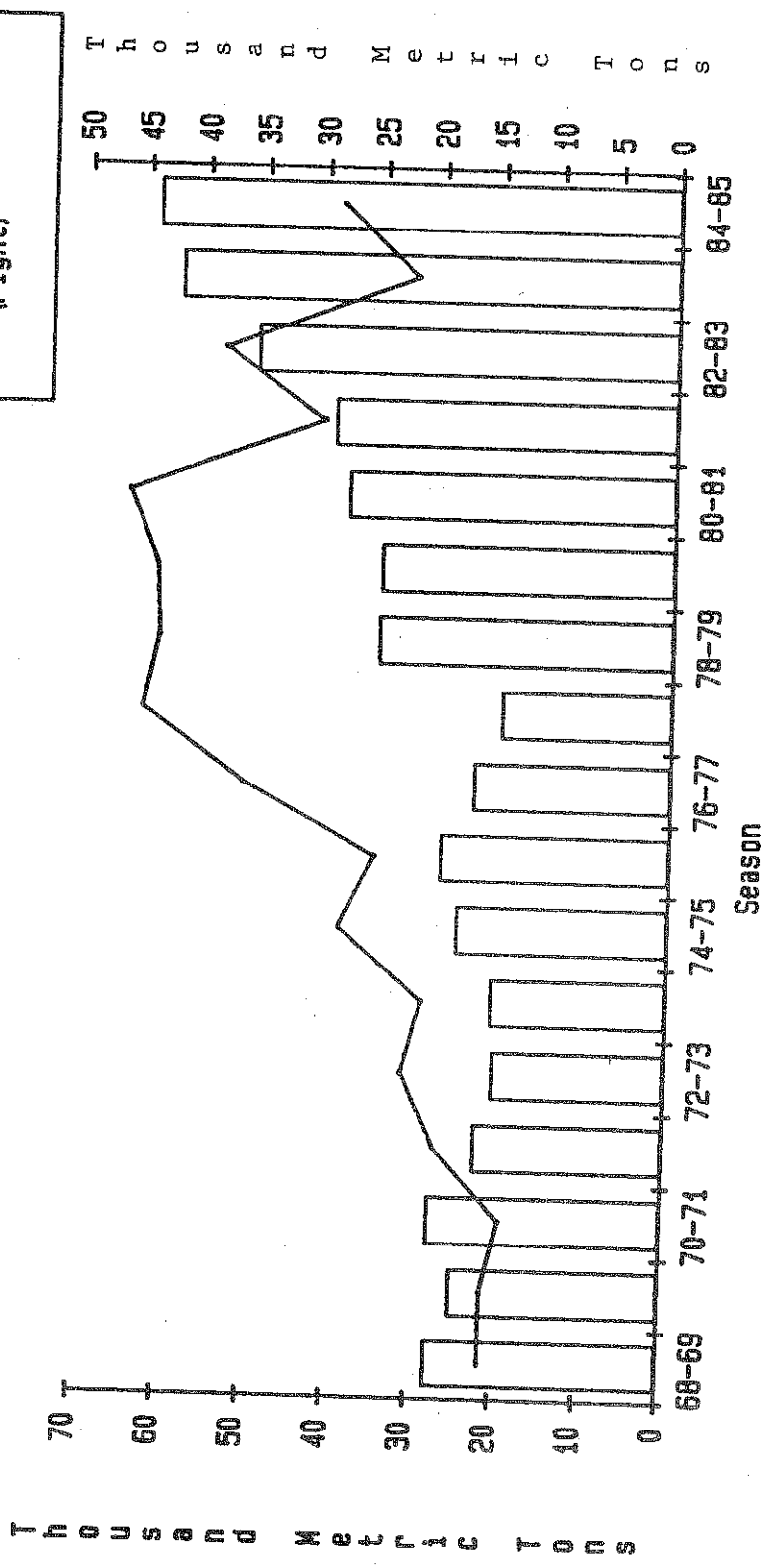


Source: U.S. Commerce, U.S. General Imports: Schedule A: Commodity by Country.

The disease problem results from a blight (alternaria dauci) which is caused by airborne fungi (Lucas; Walker). The blight can cause extensive damage to mature plants and seedlings. It is a particular problem in Florida because of the high rainfall which is a major contributor to the spread of the disease. Central Florida receives 40 to 60 inches of rain a year, while other carrot producing regions receive less than 40 inches. Central Florida is also subject to freezing temperatures in January and February. The amount of damage depends on the intensity of the freeze, although affected areas may be replanted. Killing frosts occurred three seasons in a row (January 1982, Christmas 1983, and January 1985), causing significant damage.

Shipments of carrots from Florida increased from roughly 15 thousand metric tons in the 1968-69 marketing year to over 45 thousand tons in 1977-78 (figure 3.7). After 1980-81, alternaria dauci and freezing temperatures hindered the ability of Florida to ship out of state. Shipments dropped from 47 thousand metric tons in 1980-81 to 30 thousand in 1981-82, 37 thousand in 1982-83, 23 thousand in 1983-84, and 29 thousand in 1984-85. Canadian industry personnel claim that their industry was able to increase its shipments into Florida's markets because of the state's production problems. Although it is difficult to prove that Canadian exports increased due to Florida production problems, there does appear to be a correlation between the two.

Figure 3.7: Comparison of Canadian Carrot Exports and Florida Shipments



Source: Statistics Canada and Florida Dept. of Ag. and Consumer Services.

4. INTERNAL FACTORS AND INCREASED EXPORTS

The change in the exchange rate, U.S. tariff, and Florida production problems have provided external incentives that have influenced the volume of Canadian exports to the United States. The factors discussed in this section are internal to Canadian agriculture. They are production costs, government subsidies, and storage.

Production Costs

The level of production costs affects the competitive position of a firm or region both nationally and internationally. The purpose of this section is to ascertain the competitiveness of Canadian fresh carrot producers with respect to their U.S. counterparts. The analysis examines competitiveness in terms of comparative production costs.[3]

Insofar as the comparison of production costs across regions or countries is valid, the appropriate basis for comparison is marginal costs. Economic theory suggests that the costs of producing the marginal unit of output determine the region's supply curve and the level of total output at any given price. Unfortunately, without the determination of a regional total cost curve, it is difficult to compute marginal costs at a particular level of output. The determination of such total cost curves is complex, time-consuming, and outside the scope of this study.

As a result, a simple but less theoretically valid comparison is made based upon average costs of representative farms in each region. These costs are computed from farm budgets which are based on representative production practices and expenses. Only under the highly restrictive assumption that the firms in each region are in equilibrium will the costs thus computed approximate marginal costs at the particular level of output. In this case, under competitive conditions, marginal and average costs will be equal. Nevertheless, the estimates derived allow qualitative conclusions to be drawn about relative competitiveness, at least in the short-run.

Yearly per acre published production budgets were gathered for Ontario (Bradford Marshes), Quebec, California (Kern County), South Texas

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[3] It should be stressed that this comparison has little if anything to do with the basic trade theory concept of comparative advantage. This theory demonstrates that global economic welfare can be increased if nations are allowed to specialize in the production of those commodities in which they are most efficient. The theory is founded on cost comparisons across industries within individual countries, rather than between countries. Given fixed resources in each country and competitive markets, the comparative efficiency of production in alternative domestic industries, combined with consumer preferences, determines the pattern of production and the gains from trade. Production cost comparisons across countries refer to absolute rather than comparative advantage. The theory clearly demonstrates that the comparison of absolute costs among countries provides little guidance to the pattern of trade that might result under competitive conditions.

(Rio Grande Valley), and Southwest Texas (Winter Garden) for the 1976-86 period. Budgets for each region are not available for every year. A 1986 budget was estimated for New York (Orange County). Although Quebec and Ontario compete more directly with the Northeast and Midwest, published production budgets could not be obtained for these regions.

The use of irrigation, custom harvesting, and packout rates vary by region. Texas and California producers irrigate and custom harvest, while New York and Canadian producers do not irrigate and operate their own combines. Budgets from the six regions were placed in a standardized format (for the complete set of budgets and procedures see Bierlen). Costs were divided into fixed and variable. Budgets were aggregated across certain items in some areas for purposes of comparability. Relevant costs include soil preparation, growing, and harvesting, but do not include an allowance for producer labor and management. The average cost per bag (50 pounds) was found by dividing the total cost per acre by the packout rate, which is the average number of bags salable on the fresh market per acre. The break-even cost (average cost per bag) is the price per bag which the producer must receive to cover all the included costs.

A few comments should be made about the preparation of budgets. The approach usually taken is to prepare budgets that are representative of costs in the regions. Published budgets in general are poor in stating assumptions, and the ones used in this study are no exception; the major problem is the failure to state the method of depreciation. The 1986 New York budget had to be independently developed due to the lack of published ones. The New York budget assumed carrots and onions were planted equally on 100 acres of muckland in Orange County, New York. Assumptions were made concerning production practices and ownership of machinery. Cost estimates were derived from published sources, suppliers, and New York producers.

Average cost per bag in nominal U.S. and Canadian dollars for the regions considered are presented in table 4.1. In spite of higher inflation, Canadian dollar costs are competitive with U.S. costs expressed in U.S. dollars. New York (1986) and California are the lowest cost producers. Ontario costs are lower than both regions in Texas. Quebec is the highest cost producer, but it is competitive with the two Texas regions. With packout rates of 700 bags and over, California and New York are the lowest cost producers in the United States. Ontario is the lowest cost producer in Canada; packout rates are the largest determinant of average costs per bag. Not having to install and operate irrigation equipment aids in keeping New York, Quebec, and Ontario costs competitive. In 1986, irrigation costs added 35 cents and 15 cents per bag to costs in Southwest and South Texas, respectively.

When Canadian costs are converted to U.S. dollars, the results are as though Canadian costs had not increased over the 1976 to 1986 period. This is shown in table 4.2. From 1981 to 1986 Ontario costs (U.S.$) are generally below all U.S. regions; and Quebec costs are below the Texas regions. The gap between Quebec, and New York and California costs, has narrowed. Quebec costs have actually declined in U.S. dollars since 1976.

As indicated in section 3 above, the change in the exchange rate has more than offset any difference in the rate of increase in costs between

Table 4.1. U.S. and Canadian Carrot Production Costs per Bag in National Currencies

Year	N.Y.	SW Texas	S. Texas	Cal.	Ont.	Que.
1976		$1.67			$1.43	$1.94
1977		$1.82				
1978		$1.85				
1979		$1.87				$2.04
1980		$2.01	$1.86			$2.22
1981		$2.05	$1.96	$1.52	$1.85	$2.32
1982		$2.14			$1.87	$2.28
1983		$2.17	$2.11			$2.31
1984		$2.39				
1985		$2.47	$2.26		$1.95	
1986	$1.57	$2.46	$2.31	$1.65	$2.02	$2.58

Source: Bierlen.

Table 4.2. U.S. and Canadian Carrot Production Costs per Bag in U.S. Dollars

Year	N.Y.	S.W. Texas	S. Texas	Cal.	Ont.	Que.
1976		$1.67			$1.45	$1.97
1977		$1.82				
1978		$1.85				
1979		$1.87				$1.74
1980		$2.01	$1.86			$1.90
1981		$2.05	$1.96	$1.52	$1.54	$1.94
1982		$2.14			$1.52	$1.85
1983		$2.17	$2.11			$1.87
1984		$2.39				
1985		$2.47	$2.26		$1.43	
1986	$1.57	$2.46	$2.31	$1.65	$1.46	$1.86

Source: Bierlen.

U.S. and Canadian industry as a whole. As a result, the depreciation of the Canadian dollar against its U.S. counterpart has improved the competitive position of Canadian exporters as a whole in U.S. markets. However, this conclusion may not necessarily hold for producers and exporters of carrots. It is possible that their costs relative to U.S. competitors have increased more rapidly than for other Canadian industries. This possibility may be examined by calculating an index of competitiveness for carrots and comparing this to the economy-wide index presented earlier in section 3.

Unfortunately, as may be seen from table 4.1, the cost estimates available to make this comparison for carrots are limited. A reasonably complete series exists only for S.W. Texas and Quebec. As a consequence, the index was calculated from the figures for these two regions with 1976 as a base year. Missing years for Quebec were estimated by linear interpolation. The resulting index and its economy-wide counterpart are graphed in figure 4.1. This chart suggests that the rate of increase in production costs for carrots in Canada has been less than that in the United States. As a result, the index of competitiveness for carrots has increased at a more rapid rate than the general index of competitiveness. If this is the case, then the change in the dollar exchange rate has been more significant for the Canadian carrot industry than for the Canadian industry as a whole.

This conclusion is dependent on the data used, and in particular the production cost characteristics of the two regions. As indicated earlier, both of these regions are relatively high cost areas in their respective national contexts. Quebec costs are higher than those in Ontario. Texas costs are higher than those in New York and California. However, the absolute cost levels are not in themselves significant for the comparison of changes in competitiveness. What is important is how costs have changed through time, and whether these changes are reasonably representative for the industries in the two countries as a whole. Since Texas producers use irrigation and custom harvesting, their costs are probably less representative for northeast or midwest producers than they are for other southern or western producers. The increased cost of energy, in particular, has probably had a greater impact on irrigated production than on nonirrigated production.

As a consequence, the index of relative competitiveness based upon Quebec and S.W. Texas figures probably does not provide a reliable estimate of changes in the competitive position of Canadian and northern U.S. producers. If data were available to make the calculations, this index would probably have increased at a slower rate than the carrot index in figure 4.1. However, it is unlikely that the qualitative conclusion which may be drawn from the chart would be different. The competitive position of Canadian producers has probably improved significantly relative to all U.S. regions as a result of the depreciation of the Canadian dollar.

Canadian Government Programs

When U.S. industries complain about "unfair competition" from imports, the basis of their complaints often centers on government subsidization. U.S. producers argue that due to foreign government

Figure 4.1: General Industrial Competitiveness of Canada and Competitiveness of Carrot Producers

Source: Bierlen and IMF.

subsidies they are priced out of the domestic market. In effect, domestic producers are not competing against foreign producers, but the exchequers of foreign governments. The purpose of this section is to quantify the magnitude of Canadian government subsidies to Quebec and Ontario carrot producers. Subsidies are defined as direct government expenditures or intervention that reduce producer costs or raise producer income.

Subsidization may increase net income by either reducing costs or by raising output prices. If minimum or floor prices are set, as in income stabilization programs, returns can be increased and price risk reduced. Increased net income and reduced price risk via government subsidies are likely to result in increased production in the long run.

There are three levels of Canadian government subsidies affecting agriculture: federal government programs, provincial government programs, and joint federal-provincial programs. Of the latter programs, the federal government signs unique agreements with each province and the provincial government has the option of nonparticipation.

Canadian government programs fall under one of four categories: credit, grants, crop insurance, and price stabilization. Both the federal and provincial governments offer agricultural credit. The Farm Credit Corporation (federal government) is the largest lender. The province of Ontario does not lend to agricultural producers, but rather has programs which make payments to reduce interest on loans through other farm lending programs in which producers participate. Many programs are in the form of grants which do not have to be repaid. Such grants are generally awarded for specific purposes, e.g., tile drainage or cold storage facilities, and pay one-fourth to one-half of capital costs.

There are joint federal-provincial crop insurance programs; producers pay 50 percent of the premium and the federal and provincial governments share the remaining costs. Under the federal agricultural stabilization act, producers are guaranteed a return on named commodities of at least 90 percent of the average price over the previous five years. Support prices are fixed annually. Guaranteed returns may increase year to year due to increasing land values, causing a ratchet effect.

The first step in quantifying the magnitude of subsidies is to list all programs that directly benefited producers in the 1970-84 period. These programs are listed in table 4.3 (for a more detailed description, see Bierlen). The annual expenditures on fresh carrots under these programs are estimated for the years in parentheses after the program's title. Expenditures could not be obtained in all cases. Those programs for which figures could be obtained are denoted by a number in parentheses in the two right hand columns under Quebec and Ontario. When the fiscal year and calendar year do not coincide, the expenditures in the fiscal year are allocated to the respective calendar year on the basis of the number of months of each calendar year present in the fiscal year. To calculate the subsidy on loans, the average yearly interest rate for the loan program is subtracted from the prime rate plus 2 1/2 percent for long-term loans and 1 1/2 percent for medium-term loans. The interest differential is considered to be a subsidy. The subsidized interest rate is multiplied by

Table 4.3. Canadian Federal and Provincial Government Programs

	Quebec	Ontario
Federal Programs		
Farm Credit Corp. Lending Program (1970-84)	(1)	(1)
FCC Farm Syndicates Credit Act (1970-84)	(1)	(1)
Federal Business Development Bank (1970-84)	(1)	(1)
Veteran's Land Act (1970-84)	(1)	(1)
Fruit and Veg. Cold Storage Program (1974-84)	(2)	(3)
Crop Insurance (1978-84)	(4)	(5)
Agricultural Stabilization Act (1976 and 1982)	(6)	(6)
Advance Payments for Crops Act		
Housing for Seasonal Workers		
Small Farm Development Program		
Quebec Programs		
Act to Promote Development of Ag. Operations, Grants		
Act to Promote Development of Ag. Operations, Land Improvements		
Act to Promote Development of Ag. Operations, Development of Unused Lands		
Development, Improvement and Maintenance of Municipal Watercourses		
Underground Drainage		
Farm Credit Act		
Act to Promote Special Credit to Farm Producers During Critical Periods		
Farm Improvement Act		
Interest Subsidy to Quebec Borrowers for F.C.C. and V.L.A.		
Partial Reimbursement of Municipal and School Taxes		
Subsidy for the Purchase of Ground Ag. Limestone		
Subsidy for Marl		
Assistance for the Transportation of Granulated Fertilizers		
Horticultural Storage		
Ontario Programs		
Tile Drainage Act (1970-84)		(7)
Dev. of Ag. Drainage and Water Resources (1970-84)		(7)
Soil Cons. and Env. Protection Assistance(1983-84)		(7)
Farm Fuels Storage Tanks (1982-83)		(7)
Farm Wells		
Young Farmers Credit Program		
Ontario Farm Adjustment Assistance Program		
Ontario Beginning Farmer Assistance Programs		
Farm Tax Reduction		
Ont. Family Farm Interest Rate Reduction Program		
Farm Operating Credit Assistance Program		
Ontario Storage and Packing Assistance Program		(3)

-continued-

Table 4.3. -Continued-

(1) National expenditure averaged over all Canadian production receipts.
(2) Quebec expenditure averaged over Quebec carrot, beet, rutabaga, onion, apple, cabbage, and potato receipts.
(3) Ontario expenditure averaged over Ontario cabbage, cauliflower, carrot, parsnip, beet, rutabaga, apple, and pear receipts.
(4) 50% of Quebec expenditure averaged over carrot, parsnip, turnip, and onion receipts.
(5) 50% of Ontario expenditure averaged over cabbage, cauliflower, and carrots for 1978-81 and carrots for 1981-84.
(6) Support on per pound basis for total carrot crop.
(7) Averaged over all Ontario production receipts.

Source: Bierlen.

the average yearly credit outstanding to estimate average yearly subsidized interest.

In order to gauge the size of the subsidies, there is a need to standardize the subsidy amounts. There are three methods of doing this. The subsidy can be expressed per producer, per acre or per bushel, and as a percentage of farm receipts. There are problems with the first two methods. An agricultural census is only taken every five years in Canada and the number of producers is not known on a yearly basis. Furthermore, carrot producers often grow vegetables other than carrots, so that the number of carrot producers in a given year is not a particularly meaningful basis for comparison. Finally, it is often impossible to separate monies that the producer receives for carrots from those for other vegetables. When orchards and cattle ranches are involved in multiple-crop enterprises, it is inappropriate to use acres as a unit of standardization. Only by expressing subsidies as a percentage of farm receipts can the above problems be avoided.

Many of the recorded subsidy payments are often not disaggregated by individual commodities. Recorded expenditures often apply to all national or provincial agricultural producers. When the subsidy could not be disaggregated for carrots, it was assumed that carrot producers received the same proportion of the total subsidy as their percentage of total farm receipts. The footnotes in table 4.3 indicate what receipts are used to average program expenditures. The farm receipts for carrot producers in Quebec and Ontario include both fresh and processing carrots.

In order to estimate the total effect of the programs, total payments were summed across all programs for which expenditures were available. The estimated total subsidy in Canadian dollars, subsidies as a percentage of fresh and processing carrot farm receipts, and subsidy per pound are listed in tables 4.4 and 4.5 for Quebec and Ontario. Because the analysis assumes that carrot growers receive average benefits in some programs, subsidies as a percentage of farm receipts are highly dependent on interest rates, fluctuating farm receipts, and stabilization board payments. Due to the above and the fact that all programs in the period do not run concurrently, only the range of subsidies will be discussed rather than the specific figures.

For Quebec, annual estimated subsidies as a percentage of carrot farm receipts range from 0.6 percent to 14.6 percent. The average is 2.9 percent and the standard deviation is 3.44 percent. This includes only federal subsidies, as Quebec program expenditures were unavailable. For Ontario the range of subsidies as a percentage of carrot farm receipts is 1.2 to 14.1 percent. The average is 3.7 percent and the standard deviation is 3.7 percent. The annual subsidy per pound for Quebec ranges from 0.02 to 0.69 cents and for Ontario it ranges from 0.04 to 0.61 cents. There is no discernible trend in the Quebec subsidies. For Ontario, subsidies have increased since 1979. The difference in trend between the two may be explained by the fact that the Ontario figures include payments under the Ontario cold storage program, whereas the Quebec cold storage program is not included in the Quebec figures. Payments were made to carrot producers under the agricultural stabilization program for the 1975 and 1982 crops,

Table 4.4. Subsidies to Quebec Carrot Producers in Canadian Dollars

Year	Percent of receipts	Estimated subsidy	Cents per pound
		($1,000)	
1970	1.3	$ 43.6	$0.02
1971	0.8	23.2	0.02
1972	0.6	17.4	0.02
1973	1.3	39.8	0.03
1974	1.5	61.4	0.05
1975	4.6	268.8	0.16
1976	1.5	77.9	0.05
1977	1.7	90.1	0.06
1978	3.0	263.9	0.15
1979	2.7	261.2	0.12
1980	3.6	677.4	0.25
1981	4.0	534.4	0.24
1982	14.6	1,462.3	0.69
1983	1.3	216.9	0.13
1984	1.4	161.7	0.08

Source: Bierlen.

Table 4.5. Subsidies to Ontario Carrot Producers in Canadian Dollars

Year	Percent of receipts	Estimated subsidy	Cents per pound
		($1,000)	
1970	1.6	$ 63.3	$0.04
1971	1.6	47.8	0.05
1972	1.3	50.0	0.04
1973	1.6	58.4	0.04
1974	3.2	121.6	0.08
1975	5.5	258.4	0.12
1976	1.6	76.5	0.06
1977	1.3	84.1	0.07
1978	2.1	244.4	0.12
1979	3.3	274.5	0.12
1980	3.9	306.3	0.26
1981	4.3	504.5	0.24
1982	16.2	1,678.2	0.61
1983	3.3	761.0	0.30
1984	4.1	406.8	0.14

Source: Bierlen.

the two years in which subsidies as a percentage of cash receipts were highest.

An alternative way to evaluate the size of government subsidies is to compare them to estimated production costs for those years in which data are available in table 4.1. These data in Canadian cents per pound are given in table 4.6. The figures indicate that for Quebec subsidies relative to production costs have ranged from roughly 2 percent to 18 percent. The latter figure corresponds to a year of high stabilization program payments. The Ontario figures, which are more numerous, suggest a range of roughly 1 percent to 15 percent. If the stabilization payment year of 1982 is excluded, the range is roughly 1-6 percent of production costs.

Table 4.6. Canadian Government Subsidies Relative to Production Costs per Pound (Canadian) in Ontario and Quebec

Year	Production costs	Government subsidies	Percent	Production costs	Government subsidies	Percent
1976	3.88	0.05	1.3	2.86	0.05	1.7
1979	4.08	0.12	2.9	NA	0.12	NA
1980	4.44	0.25	5.6	NA	0.25	NA
1981	4.64	0.24	5.2	3.70	0.24	6.5
1982	4.56	0.69	15.1	3.74	0.69	18.4
1983	4.62	0.13	2.8	NA	0.13	NA

Source: Calculated from tables 4.1, 4.4 and 4.5.

Apart from those years in which stabilization payments were made, the size of the subsidies paid to Canadian carrot producers, evaluated either in terms of receipts or production costs, does not appear to be large. Since the subsidies are not targeted specifically toward exports, their effect upon trade is not clear. The subsidies may have contributed to increased production, although this depends on whether subsidy payments have changed the returns in the production of carrots relative to alternative crops. Since many of the subsidies provided are not specific to carrots, they may simply have contributed to the maintenance of income and asset values in eastern Canadian agriculture in general, without having a marked effect upon the level of output of carrots per se. As a consequence, their effect upon the level of exports may not have been large. This conclusion, although tentative, is reinforced by further analysis in section 5 in which the relative magnitude of government subsidies is compared to some of the other factors affecting producer returns from exports.

Storage

As previously discussed in section 2 above, storage lengthens the marketing season and results in a longer export period. Prior to the 1970s, most Canadian exports had ceased by January. Carrots are currently exported through March and often into April. If exports are to be

increased, it is more appropriate to extend sales over a longer marketing year, in order to avoid depressing prices, through increased shipments during a shorter period. The quantity of fresh carrots exported per month has not increased as dramatically as total marketing year exports. It appears that storage has been used as a means of increasing both domestic production and exports.

The building of additional farm-level storage structures in Canada was not totally due to prevailing market forces. Canadian policymakers saw storage as a means to greater food security. Increased storage has aided in increasing the ratio of domestic carrots in consumption, since domestic carrots can now be substituted for imported carrots in the winter and spring. Both the Canadian federal government and the provincial governments of Quebec and Ontario passed legislation in the 1970s to aid builders of storage facilities (see Bierlen for details of these programs). The programs contributed one-third to one-fourth of capital costs.

If it can be demonstrated that storing carrots is a profitable operation in Canada without government subsidies, then storage's role as a facilitator of exports is strengthened and it could be argued that increased production and exports may have occurred even without government intervention. Cost-return studies were undertaken for storage structures in both Quebec and Ontario. Returns were computed from the difference in prices from a base harvest month and the following storage months. Fixed and variable costs of a typical storage unit were estimated.

Semi-perishable commodities such as carrots are harvested in a brief period and sold out of storage throughout the year. There is no year-to-year carry over. Prices rise throughout the year as a function of storage costs. It is assumed that seasonal prices are sufficient for some producers to sell and others to continue holding inventories in expectation of greater returns. As the following harvest year approaches, prices drop. In the long run, the product is stored if the returns from storage meet or exceed the costs of storage. Because of their availability, monthly Montreal and Toronto terminal market prices are used to determine storage returns. Both markets exhibit rising prices throughout the storage season.

With the use of wholesale prices, it is assumed that farm and wholesale prices follow one another closely and that the marketing margins of packers and wholesalers remain constant, on average, over the marketing season. The correlation between monthly prices in Montreal and Toronto is 0.97 for the ten-year period ending in 1984-85. Montreal and Toronto wholesale prices were examined to see if they contained a seasonal price trend over the 1970-85 period. To test for this, a ratio was formed by dividing November through April's prices by October's price for each marketing year. If these ratios increase (decrease) it indicates that the potential storage price premium is increasing (decreasing) and that some possible structural change took place in the market. Each monthly ratio for the period was graphed. These graphs reveal less price variability in more recent years, but do not suggest that the potential returns to storage have increased or decreased systematically through time.

Storage in Quebec. Quebec fresh carrot production areas are located in close proximity to Montreal. Agriculture Canada quotes weekly price

spreads for 24-2 Quebec carrots on the Montreal terminal market. Average monthly prices were calculated for the 1970-71 to 1984-85 period and then deflated by the Canadian wholesale index where November 1985 is equal to 1. October's price is subtracted from January and the following months' prices to obtain the monthly price premium for storage for each of the 15 marketing years. These price premiums were averaged for the 1970-71 through 1984-85 period.

In order to derive returns to storage, the volume placed into storage and the pattern of removals must be known. The Quebec monthly storage statistics are used to calculate removals. Agriculture Canada conducts a storage census on the first day of the months of November through May. It is assumed that November is the first month of storage, the storage is fully loaded on the first of November, and, beginning in January, it is gradually emptied until supplies are exhausted at the end of May. Carrots are actually withdrawn from storage in November and December in Quebec, but it is assumed that these are from nonrefrigerated storage.

To calculate the pattern of removals in Quebec, the storage figures for January and the following months were divided by January's figure so that each month's storage figure is a percentage of January's. In this manner, percentages are computed each year and averaged for the 1970-71 to 1984-85 period. This is the percentage of total capacity that, on average, was being used for storage on the first of each month. With this information, the gross returns for a representative 862 ton Quebec storage facility can be computed (see Bierlen for a description of the Quebec storage structure and further details on data employed).

A major consideration in the calculation of returns is the loss due to spoilage. Due to deterioration, the longer carrots are stored, the higher this spoilage or cull rate. Cull rates are highly variable. In the analysis, a 20 percent initial (time of harvest) cull rate is assumed, 25 percent in January and February, and 35 percent in March through May. These rates were estimated through conversations with packers and extension agents in Quebec and Ontario.

The monthly value of tons marketed is obtained by multiplying the total storage capacity by the percentage coming out of storage, by the noncull rate, and the monthly storage premium. The percentage coming out of storage for a month is the percentage of capacity in storage on the first of that month less the percentage on the first of the following month. The yearly gross storage returns are the sum of the monthly returns. The Quebec monthly and yearly gross storage returns (excluding waste) are in table 4.7.

An added cost is incurred in storage through the loss of some of the stored quantity because of deterioration in storage. There are two ways in which such culls may be valued. One is to use the market price at the time of their removal from storage (the "opportunity cost" approach). The other is to use the market price at the time of harvesting (the "sunk cost" approach). In order to derive the opportunity cost valuation, the additional quantity of carrots which is lost due to deterioration in storage is multiplied by the storage month's market price. This results in an estimate of the average loss due to additional storage waste of $18,756.

Table 4.7. Gross Returns for a Representative Quebec Storage

Month	Returns
I. Returns Excluding Storage Waste	
January: 862 tons x 0.38 x 0.75 = 245.67 tons	
245.67 tons @ $91.60 =	$22,503
February: 862 tons x 0.30 x 0.75 = 193.95 tons	
193.95 tons @ $134.30 =	26,047
March: 862 tons x 0.21 x 0.65 = 117.66 tons	
61.63 tons @ $145.20 =	17,085
April: 862 tons x 0.07 x 0.65 = 39.22 tons	
39.22 tons @ $189.60 =	7,436
May: 862 tons x 0.04 x 0.65 = 22.41 tons	
22.41 tons @ $196.40 =	4,402
Total Returns Excluding Storage Waste	$77,473
II. Gross Return - Sunk Cost Method	
Total Returns Excluding Storage Waste	$77,473
Storage Waste Valued Harvest at Price	
(70.68 tons @ $125.00)	-8,835
Gross Returns	$68,638
III. Gross Return - Opportunity Cost Method	
Total Returns Excluding Storage Waste	$77,473
January Waste (862 tons x 0.38 x 0.05 x $216.60)	-3,547
February Waste (862 tons x 0.30 x 0.05 x $259.30)	-3,363
March Waste (862 tons x 0.21 x 0.15 x $270.20)	-7,337
April Waste (862 tons x 0.07 x 0.15 x $314.60)	-2,847
May Waste (862 tons x 0.04 x 0.15 x $321.40)	-1,662
Gross Returns	$58,727

Assumptions

October cull rate of 20%
January and February cull rate of 25%
March to May cull rate of 35%
October price of $125/ton

Source: Bierlen.

Using the sunk cost method to value the additional quantity of culls, the figure is $8,835.

The total gross return in November 1985 dollars for a 862 ton Quebec storage in a typical year for the 1970-71 to 1984-85 period when it is emptied in an average manner is $58,727 with the opportunity cost method and $68,636 with the sunk cost method. In order to calculate the net return to storage, the cost of storage must be subtracted from the gross returns. The cost estimates are based on a typical carrot storage structure (for a description of this building, refrigeration estimates, an example of estimated monthly electrical costs and sources, see Bierlen). Cost estimates in 1986 Canadian dollars are in table 4.8.

Fixed costs were aggregated and financed over a period of 15 years (the assumed life of the structure). The method used is similar to the calculation of depreciation and interest charges. The total fixed cost with an added finance charge is $203,147. The monthly finance payments are $2,504 and the yearly payment is $30,047. Subtraction of this amount from gross returns shows that the yearly variable costs sum to $21,326. The rental cost of the forklift, the electricity, the insurance, the hired labor and returns to management, and the upkeep of pallets, refrigeration hardware, and building are the major variable costs. The yearly net returns using the more stringent opportunity cost method of valuing spoilage are $7,354, a 12.5 percent rate of return. Net returns using the sunk cost method of spoilage valuation is $17,265, a 25 percent rate of return. These figures show that, on average, the Quebec storage is a profitable operation.

Storage in Ontario. The price premiums for storage are calculated for an Ontario facility in the same manner and with the same assumptions as those for Quebec. Prices used to calculate storage price premiums are from the Toronto terminal market. The calculation of withdrawal from storage uses Ontario statistics. Assuming the same cull rates as in Quebec, the gross returns to storage for Ontario in table 4.9 are $46,353 (opportunity cost method). This includes an $18,368 loss due to a higher cull rate in storage. When the sunk cost method is used, the loss is $9,462 and the gross returns are $55,508.

The fixed costs total $189,569, which are slightly less than for Quebec (table 4.10). The number of square feet and the cost per square foot were both slightly less than in the Quebec structure. This resulted in a saving of $15,696. The monthly finance payment is $2,336 and the yearly payment is $28,036. The total yearly variable costs are $17,848 and total annual costs are $45,880. The net return using the opportunity cost method is $473, a one per cent rate of return. With the sunk cost method, the annual net return is $9,628, a 15 percent rate of return.

The two cost-return studies do not include family labor costs, and the assumption of a constant packer margin is probably simplistic. Packing costs rise with higher cull rates. Thus, packer margins should increase throughout the storage season, with the result that gross returns and net returns are reduced. Despite these limitations, the estimates derived suggest that storage facilities in both Quebec and Ontario are paying propositions. Under a good marketing strategy, with success at keeping

variable costs down, profits can be high. Even with the more stringent opportunity cost approach to valuing storage waste, net returns are positive. Under the sunk cost method of waste valuation, returns on investments are 25 percent for the Quebec structure and 15 percent for Ontario. A government grant would reduce costs and increase profits, but a carrot storage can be built and operated profitably without direct government aid.

Table 4.8. Costs and Returns for a Representative Quebec Carrot Storage Unit

I. Fixed Costs		
Bldg. (114 ft x 40 ft x $16.60/sq ft)		$ 75,696
Housing for compressors (10 ft x 10 ft x $16.60/sq ft)		1,660
Electrical system		7,000
Refrigeration system (16 and 30 hp with freon-22 = 35.29 tons x $2,000)		70,580
Humidifier (20 ltrs/hr)		1,000
Pallets (1230 x $37.50)		46,200
Finance charge(0.005 x $202,136)		$1,011
Total needed to finance for 15 years		$203,147
Finance $203,147 at 12.5% interest for 15 years in equal monthly payments		$ 2,504
Yearly finance charge = 12 x $2,504	A	$ 30,047
II. Yearly Variable Costs		
Repair and upkeep of pallets ($1.25 x 1232)		$ 1,540
Building repair and maintenance		650
Forklift fuel and tank rental		135
Forklift rental (7.33 months x $750)		5,498
Refrigeration repair and maintenance		500
Electrical power		4,412
School taxes (0.001823 x $161,356)		294
Property taxes (0.00206 x $161,356)		332
Insurance, building and fixtures		1,565
Insurance, carrots		603
Hired labor and returns to management		3,970
Interest on operating capital		1,827
Total Variable Costs	B	$ 21,326
III. Yearly Fixed and Variable Costs	A + B	$ 1,373
IV. Net Return - Sunk Cost Method		
$68,638 - $51,373 =		$ 17,265
V. Net Return - Opportunity Cost Method		
$58,727 - $51,373 =		$ 7,354

Source: Bierlen.

Table 4.9. Gross Returns for a Representative Ontario Storage

Month	Returns
I. Returns Excluding Storage Waste	
January: 810 x 0.34 x 0.75 = 206.55 tons	
206.55 tons @ $80.00 =	$16,524
February: 810 x 0.25 x 0.75 = 151.88 tons	
151.88 tons @ $123.20 =	18,711
March: 810 x 0.20 x 0.65 = 105.30 tons	
105.30 tons @ $121.20 =	12,762
April: 810 x 0.09 x 0.65 = 68.45 tons	
68.45 tons @ $144.40 =	9,884
May: 810 x 0.08 x 0.65 = 42.12 tons	
42.12 tons @ $162.40 =	6,840
Total Returns Excluding Storage Waste	$64,721
II. Gross Returns - Sunk Cost Method	
Total Returns Excluding Storage Waste	$64,721
Storage Waste Valued at Harvest Price	
73.70 tons @ $125	9,213
Gross Returns	$55,508
III. Gross Returns - Opportunity Cost Method	
Total Returns Excluding Storage Waste	$64,721
January Waste (810 tons x 0.34 x 0.05 x $205.00)	-2,823
February Waste (810 tons x 0.25 x 0.05 x $248.20)	-2,513
March Waste (810 tons x 0.20 x 0.15 x $246.20)	-5,983
April Waste (810 tons x 0.13 x 0.15 x $269.40)	-4,255
May Waste (810 tons x 0.08 x 0.15 x $287.40)	-2,794
Gross Returns	$46,353

Assumptions

October cull rate of 20%
January and February cull rate of 25%
March to May cull rate of 35%
October price of $125 per ton

Source: Bierlen.

Table 4.10. Costs and Returns for a Representative Ontario Storage Unit

I. Fixed Costs		
Bldg. (100 ft x 40 ft x $15.00/sq ft)		$ 60,000
Housing for compressors (10 ft x 10 ft x $15.00/sq ft)		1,500
Electrical system		6,400
Refrigeration system		77,626
Pallets (1080 x $40.00)		43,200
Finance Charge: (0.005 x $188,626)		943
Total needed to finance for 15 years		$189,569
Finance $189,569 at 12.5% interest for 15 years in equal monthly payments		$ 2,336
Yearly finance charge (12 x $2,336)	A	$ 28,336
II. Yearly Variable Costs		
Repair and upkeep of pallets ($1.25 x 1080)		$ 1,350
Building repair and maintenance		600
Forklift fuel and tank rental		101
Forklift rental (7.33 x $835)		6,123
Refrigeration repair and maintenance		500
Electrical power		2,435
Property and school taxes (0.40272 x $1200)		483
Insurance, building and fixtures		1,021
Insurance, carrots		431
Hired labor and returns to management		3,275
Interest on operating capital		1,529
Total Variable Costs	B	$ 17,848
III. Yearly Fixed and Variable Costs	A + B	$ 45,880
IV. Net Return - Sunk Cost Method		
$55,508 - $45,880 =		$ 9,628
V. Net Return - Opportunity Cost Method		
$46,353 - $45,880 =		$ 473

Source: Bierlen.

5. THE RELATIVE IMPORTANCE OF THE FACTORS CONTRIBUTING TO INCREASED EXPORTS

Up to this point the various factors which may have contributed to increased exports of Canadian carrots have been discussed individually. In this section an attempt is made to evaluate their relative significance. The basis of the analysis is an evaluation of the effect of some of the principal factors on the profitability of shipment to a Canadian market versus a U.S. market. The factors evaluated are the effects of the tariff, exchange rate, and storage. The comparison attempts to show in a single marketing year (1985-86) how the incentive for shipment to Canadian versus U.S. markets was influenced by the factors indicated above, and the relative importance of these factors. Finally, a comparison is made between the size of this export incentive and domestic government subsidies.

Approach

Two Canadian carrot growing regions were chosen, Ste. Clotilde, Quebec and Bradford, Ontario. The costs for producing and packing a 24-2 bag of carrots were estimated for each of these regions. For Ste. Clotilde an analysis of the monthly returns from shipping to a nearby Canadian wholesale market (Montreal) and to a similar U.S. market (Buffalo) is performed. These two shipping options were also considered for Bradford, except that the Canadian market was Toronto. In order to calculate costs, transportation charges were added to growing and packing costs. For shipment to Canadian markets, these three charges constitute the total costs for the first month (October). For December through February an additional storage charge is added. Since shipments destined for Buffalo cross into the United States, the U.S. tariff must be paid in addition to the above charges. For Buffalo the total costs include production, packing, transportation, and the U.S. tariff.

The calculation of potential returns is based upon the price received in terminal markets. For shipments to Buffalo, this is in U.S. dollars. For comparison reasons, Buffalo U.S. dollar prices were converted to Canadian dollars. Since the Canadian dollar price of a U.S. dollar is greater than one, there is an exchange rate premium when U.S. dollars are exchanged for Canadian. Therefore, the price in the Buffalo market can be decomposed into the price in Canadian dollars (assuming the two currencies are on par) and the exchange rate premium in Canadian dollars. Net returns are calculated by subtracting costs from gross returns. By subtracting net returns for shipments to Canadian markets from the Buffalo net returns, the advantage of shipping to Buffalo can be determined.

Gross Returns

Estimated returns are based upon the sale prices calculated from the average monthly prices for 24-2 carrots in the three wholesale markets. The midpoints of daily price spreads were averaged for Buffalo, and weekly price spreads were averaged for Montreal and Toronto. It is assumed that equal volumes were sold on a daily and weekly basis and that the quality of carrots in the three markets was similar. Generally, prices increase over time. Buffalo prices, in U.S. dollars, are comparable to Montreal and

Toronto prices, and, when converted to Canadian dollars, are significantly higher. Toronto prices are above Montreal prices for all months.

The exchange rate premium denotes the additional Canadian dollars received in the Buffalo market because the U.S. and Canadian dollar are not at par. The returns from the exchange rate premium are large (table 5.1). They range from over $2 to $3.51 per bag and fluctuate directly with the U.S. dollar price in the Buffalo market. The exchange rate premium is the cause of a significant gap between the realized price in the Buffalo and the Canadian markets.

The Buffalo market has the largest realized price, followed by Toronto and Montreal. The large difference between the Buffalo realized price and those in Canadian markets is primarily due to the exchange rate premium.

Costs

Costs are calculated in Canadian dollars for a 50 pound master container; this is based on the assumption that 800 masters are shipped in a 40 foot refrigerated van. Total costs include production, packaging, transportation, U.S. tariff, and storage. The first column of table 5.1 contains 1986 Quebec and Ontario production costs per bag. These serve as proxies for 1985 production costs, as 1985 Quebec production costs are not available. Ontario production costs at $2.02 are 56 cents lower than those of Quebec.

Packing costs are estimated at $3.50 per bag for both regions and are assumed to be constant throughout the marketing season. Packing costs include grading, sorting, washing, and packaging. The cost of these services was estimated from conversations with packers in Quebec and Ontario. The assumption of constant packing cost should be treated with caution since packing costs are highly dependent on cull rates. More labor is required to pack carrots with a high cull rate. Thus, packing costs after November would be expected to be higher than those in October.

Transportation costs were estimated from conversations with packer-shippers in Bradford and Ste. Clotilde. St. Clotilde transportation costs are slightly higher than those from Bradford. For shipments to Buffalo this higher rate appears justified because of the greater distance from Ste. Clotilde to Buffalo than from Bradford to Buffalo. It might appear that the transportation charge from Ste. Clotilde to Buffalo is not commensurate with the mileage, in comparison to the charge from Ste. Clotilde to Montreal. Because of fixed costs there tends to be a minimum charge in truck transportation. With increasing distance the cost per mile declines. This makes closer destinations more costly per mile in comparison to more distant destinations.

The U.S. tariff of 25 cents (U.S.) is based on a master container of 50 pounds and a one-half cent per pound tariff; this was multiplied by the monthly exchange rate to determine its value in Canadian dollars. The tariff and extra transportation charges are the additional costs incurred in Buffalo shipments. The tariff does not appear to be significant in relation to the other costs. It represents a payment of $280 (Can.$) per

Table 5.1. Comparison of Costs and Returns of Shipping 24-2 Carrots from Ste. Clotilde, Quebec and Bradford, Ontario to U.S. and Canadian Markets in 1985-86 (Canadian $)

	Gross returns			Costs						Net returns	
	Market price* (1)	XR prem. (2)	Realized price (3)	Prod. costs (4)	Pack. cost (5)	Trans. costs (6)	Stor. costs (7)	U.S. tar. (8)	Total costs (9)	Net return (10)	BUF advan. (11)
Ste. Cl to Mon (Oct)	4.56		4.56	2.58	3.50	0.50			6.58	-2.02	
Ste. Cl to Buf (Oct)	5.83	2.14	7.97	2.58	3.50	1.00		0.34	7.42	0.55	2.57
Brad to Tor (Oct)	6.18		6.18	2.02	3.50	0.40			5.92	0.26	
Brad to Buf (Oct)	5.83	2.14	7.97	2.02	3.50	0.84		0.34	6.70	1.27	1.01
Ste. Cl to Mon (Dec)	7.26		7.26	2.58	3.50	0.50	0.62		7.20	0.06	
Ste. Cl to Buf (Dec)	8.00	3.16	11.16	2.58	3.50	1.00	0.62	0.35	8.05	3.11	3.05
Brad to Tor (Dec)	8.84		8.84	2.02	3.50	0.40	0.54		6.46	2.38	
Brad to Buf (Dec)	8.00	3.16	11.16	2.02	3.50	0.84	0.54	0.35	7.25	3.91	1.53
Ste. Cl to Mon (Jan)	8.94		8.94	2.58	3.50	0.50	0.93		7.51	1.43	
Ste. Cl to Buf (Jan)	8.58	3.49	12.07	2.58	3.50	1.00	0.93	0.36	8.37	3.70	2.27
Brad to Tor (Jan)	10.65		10.65	2.02	3.50	0.40	0.81		6.73	3.92	
Brad to Buf (Jan)	8.58	3.49	12.07	2.02	3.50	0.84	0.81	0.36	7.53	4.54	0.62
Ste. Cl to Mon (Feb)	8.25		8.25	2.58	3.50	0.50	1.24		7.82	0.43	
Ste. Cl to Buf (Feb)	8.68	3.51	12.19	2.58	3.50	1.00	1.24	0.36	8.68	3.51	3.08
Brad to Tor (Feb)	9.97		9.97	2.02	3.50	0.40	1.08		7.00	2.97	
Brad to Bur (Feb)	8.68	3.51	12.19	2.02	3.50	0.84	1.08	0.36	7.80	4.39	1.42

*Buffalo price in U.S. dollars.

Notes: Mon = Montreal
Buf = Buffalo
Tor = Toronto

(3) = (1+2)
(9) = (4+5+6+7+8)
(10) = (3-9)
(11) = Buffalo (10) - Canadian Market (10).

Source: Bierlen.

van load. At current prices, the pre-1969 tariff would have been as much as $500 (Canadian) per load (assuming the two currencies were on par). If the Buffalo cash sales price (Canadian dollars) were closer to total costs and to Canadian market prices, then the tariff would be more significant. Because the Buffalo price advantage is high due to the exchange rate premium, in this particular example, the tariff is less important. This is true despite the fact that the appreciation of the U.S. dollar against the Canadian dollar has also caused the tariff in Canadian dollars to increase.

Storage costs are 31 cents per master container per month in Quebec and 27 cents in Ontario. This was estimated by dividing the total storage costs for each storage structure in the cost-return study of section 4 by the number of nonculled bags, and dividing this figure in turn by 7.33 months, the number of months carrots are in storage. Storage costs were incurred for the months of December, January, and February and were calculated from mid October to the middle of the month in which the carrots were shipped. Storage costs do not include producer labor.

Total costs are given in column ten and sum the costs in the preceding five columns. Total Quebec costs are higher than those of Ontario due to higher production, transportation, and storage costs. Costs in both regions increase with time due to storage.

Net Returns

The net return given in table 5.1 is the realized price (including the exchange rate premium for Buffalo) less total costs. Net return is greatest for shipping to Buffalo, and lowest for Montreal. Because of lower costs, the total return for shipping from Bradford to Buffalo is higher than the shipment from Ste. Clotilde to Buffalo. This is consistent with Buffalo having the highest realized price. Except for October, total returns in Buffalo exceed $3 dollars per bag. Net returns increase over time, reflecting the profitability of storage.

The Buffalo advantage computed in table 5.1 is calculated as the difference between net return from selling in Buffalo less the net return from selling in the alternative Canadian market. The Buffalo advantage for Ste. Clotilde is consistently larger than that of Bradford because of Ste. Clotilde's lower total return. The Buffalo advantage ranges from $0.62 (Canadian) to $3.09, which is similar to the magnitude of the exchange rate premium. This clearly demonstrates that it was more profitable to ship to Buffalo as opposed to shipping to Montreal or Toronto, and if the exchange rate premium were to decrease, the Buffalo advantage would follow suit.

Export Incentives in Comparison to Government Subsidies

From the figures in table 5.1 and the earlier information on the size of subsidies in table 4.6, it is possible to provide a rough comparison of the importance of subsidies for Canadian producers relative to the premium from selling in U.S., rather than Canadian, markets. Table 5.2 presents this comparison using 1986 figures where these are available.

Table 5.2. Comparison of the Relative Size of Canadian Government Subsidies and Premiums for Sale in U.S. Market (Canadian cents per pound)

	Production cost (1)	Average government subsidy (2)	Average U.S. market sales premium (3)	Percentage of production cost	
				Subsidy	Sales premium
Quebec	5.16	0.28	5.5	5	107
Ontario	4.04	0.31	2.3	8	57

Sources: (1) From table 4.1 for 1986 on a per pound basis.
(2) Average of subsidies for 1980-84 from tables 4.4 and 4.5.
(3) Average Buffalo advantage for October through February for 1985-86 season from table 5.1 on a per pound basis.

The first column contains estimated production costs for Quebec and Ontario in Canadian cents per pound. These costs were derived from the production budgets discussed earlier in section 4. The second column is a "representative" subsidy level derived by averaging the yearly estimates of subsidies for 1980-84, also discussed in section 4. The third column gives the average seasonal premium for selling in the United States (Buffalo market) rather than in a nearby Canadian market (Montreal or Toronto). These premiums are contained in table 5.1.

The final two columns of table 5.2 express the subsidies and the U.S. market premiums relative to production costs. They demonstrate that the government subsidy is relatively small (5-8 percent) but that the market premium from exporting to the United States is large (57-107 percent). As was indicated above, this market premium is due primarily to the difference in currency values and the returns to storage. It is possible that producers would not receive all the sales premium from exports indicated in table 5.2. Part of the additional profits from exports may be retained by shippers and handlers, rather than by producers. However, even under a conservative assumption that producers receive only 50 percent of the extra returns for shipment to the United States, it is apparent that the relative significance of market-generated export returns for Canadian producers is likely to be of far greater significance in influencing exports than government subsidies.

6. CONCLUSIONS

This study has examined the factors that have influenced economic incentives for shipping Canadian fresh carrots to the United States. The exchange rate, the U.S. tariff, and Florida production problems are factors external to Canadian agriculture and production costs; Canadian government subsidies and the profitability of storage are factors internal to Canadian agriculture. These factors were quantified where possible and the relationship between the factors and increased Canadian shipments was established.

Since 1976 the U.S. dollar has appreciated about 30 percent against the Canadian dollar. This has resulted in a sizable exchange rate premium when Canadian carrots are shipped to the United States. When carrots are sold in Buffalo, as opposed to Montreal or Toronto, they yield substantially higher net returns in Canadian dollars.

Concessions made in GATT negotiations have changed the U.S. tariff on Canadian carrots from a 12.5 percent ad valorem to a specific tariff of one-half cent per pound. The latter results in an approximately 3 to 5 percent ad valorem tariff in U.S. dollars. This has resulted in relatively lower costs for exporters. But the appreciation of the U.S. dollar has increased the tariff in Canadian dollars, and, thus, has negated the impact of some of the reduction.

During the 1960s, Florida fresh carrot production began to increase and by the late 1970s was an important factor in markets east of the Mississippi and in Eastern Canada. After the first of the year, Florida competes with Canada in some of these U.S. markets. In the 1980s, disease and frost damage reduced Florida shipments. Canadian industry personnel claim that they were able to take advantage of this situation by increasing their shipments. Although the above scenario appears reasonable, the method needed to verify the linkage between Florida production problems and increased Canadian exports is beyond the scope of this study.

An analysis of comparative costs showed that if the difference in the exchange rate is not considered, Canadian production costs were generally higher than those in the United States. However, when costs per bag were converted to U.S. dollars, Ontario costs were slightly below all U.S. regions, and Quebec was in the middle of the U.S. range of costs. The appreciation of the U.S. dollar against the Canadian dollar resulted in Canadian production costs in U.S. dollars remaining stable over the 1976-86 period. Calculation of an index of relative competitiveness based upon data for Quebec and S.W. Texas suggests that the change in the exchange rate has had a substantial effect upon the competitive position of Canadian producers. For the two regions analyzed, the impact of the change in the value of the dollar on the competitive position of carrot producers has been greater than for the Canadian industry as a whole.

An attempt was made to estimate the value of Canadian government subsides to carrot producers. Unfortunately, this was not entirely satisfactory; the method is dependent on the prime rate and farm receipts, not all program expenditures are available, and information on expenditures disaggregated to the fresh carrot level is not available. Despite these

limitations, it appears that in comparison to the effects of the exchange rate, subsidies are relatively small even if the upper end of the estimates is assumed. Subsidies are not necessarily unimportant, but they are not a direct incentive for shipment to the United States as opposed to Canada. Subsides may have been a factor in contributing to increased supply in Canada and, hence, increased exports to the United States.

Estimates of costs and returns demonstrate that storing carrots in Canada appears to be profitable. Using alternative assumptions on the valuation of storage waste, net returns on investment are estimated to range from 12.5 to 25 percent for Quebec and 1 to 15 percent for Ontario. The necessary incentives for building storage are in place and storage can be operated profitably without government building programs. Although government aid has been provided for storage, the use of storage would probably have increased even without such aid.

Due to the magnitude of the exchange rate premium (up to 40 percent) this has to be considered the primary factor in changing the incentive for the export of carrots to the United States. When some U.S. markets are just a short distance away and net returns substantially exceed those in domestic markets, the incentive for redirecting shipments to the United States is large. Although the costs of exporting are slightly higher than selling domestically, there are additional returns in the U.S. market of roughly $1 to $3 dollars per bag, about the range of the exchange rate premium.

The expansion of storage is another important factor in explaining increased exports. Storage enables exporters to increase their shipments with less risk of depressing prices by extending the marketing season. Because storing is profitable, production is increased, and more carrots are available to be exported after the first of the year. Producers increase income not only by additional production, but also by adding value to stored carrots.

A decrease in tariffs as a result of the Tokyo/Geneva Round of GATT negotiations may have been a factor in increasing exports, but not to the extent of the above two. The tariff as a percentage of total export costs is about 3 percent, while the exchange rate premium is about 25 percent of returns. The advantage obtained by the decreased tariff has been partially offset by the appreciating U.S. dollar.

Overall, the results of the study indicate that the increase in exports of carrots from Canada to the United States is unlikely to have been due to "unfair competition", as has been alleged by some groups in the United States. The Canadian government has provided some aid to producers through subsidized credit, income stabilization programs, and other measures. However, changes in the exchange rate, and in the returns to storage, have probably been the major factors influencing Canadian exports of carrots to the United States, rather than government subsidies.

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